U.S. FISH & WILDLIFE SERVICE

FINAL AMENDED BIOLOGICAL OPINION

FOR

THE U.S. ARMY CORPS OF ENGINEERS

INTERIM OPERATIONAL PLAN (IOP) FOR PROTECTION OF THE CAPE SABLE SEASIDE SPARROW

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

March 28, 2002

TABLE OF CONTENTS

This document is the Fish and Wildlife Service's (Service) amendment to our February 19, 1999, biological opinion based on our review of the proposed action by the U.S. Army Corps of Engineers (Corps) to implement Alternative 7R (IOP-Alt.7R) under the Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow, Everglades National Park, Miami-Dade County, Florida; and its effects on the federally endangered Florida panther (panther), Cape Sable seaside sparrow (sparrow), snail kite, wood stork, and the federally threatened eastern indigo snake, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.). The Corps has requested the Service consider IOP-Alt.7R as a second Reasonable and Prudent Alternative (RPA) for water management actions to avoid jeopardy to the Cape Sable seaside sparrow in compliance with the February 19, 1999, biological opinion. The Corps has provided a detailed description and biological assessment of IOP-Alt.7 in the October 2001 Supplemental Draft Environmental Impact Statement (SDEIS) on IOP for Protection of the Cape Sable Seaside Sparrow, Everglades National Park, Miami-Dade County, Florida. Your March 15, 2002**,** request for formal consultation was received on March 18, 2002.

This amendment to our February 19, 1999, biological opinion is based on information provided by the Corps, Everglades National Park (ENP), South Florida Water Management District (SFWMD), Florida Fish and Wildlife Conservation Commission (FWC), and project information available in our files. It also includes data on the biology and ecology of threatened and endangered species in the action area, previous biological opinions prepared for similar actions in the action area, the South Florida Multi-Species Recovery Plan (MSRP) (Service 1999), and other published and unpublished sources of information. A complete administrative record of this consultation is on file in the Service's South Florida Field Office in Vero Beach, Florida.

Amended Consultation History

February through December 1999: Numerous meetings and conference calls were held between the Corps, Service, ENP, and SFWMD to discuss implementation of the 1999 biological opinion's RPA.

December 1999: Meetings with the President's Council on Environmental Quality (CEQ), to obtain guidance on National Environmental Policy Act (NEPA) coverage for emergency operations and to facilitate negotiations on points of disagreement between the Department of Interior (DOI) and the Corps, resulted in the development of the Interim Structural and Operational Plan (ISOP) 2000.

April 2000: The Service participated in interagency discussions regarding ISOP 2000 implementation. The Service made several recommendations in a Planning Aid Letter (PAL) to the Corps in an attempt to rectify shortcomings. Further discussions led to modifications of ISOP 2000, thereby resulting in ISOP 2001.

Winter 2000 through 2001: Monitoring of ISOP 2001 continued. Additional concerns arose from these monitoring results, leading to the Service issuing another PAL to the Corps on January 2, 2001.

February 2001: At the suggestion of CEQ, the Corps, Service, ENP, and SFWMD engaged the services of the U.S. Institute for Environmental Conflict Resolution to facilitate the development of an improved plan to address these concerns.

August 2001: As a result of this process, which was further reviewed and analyzed through the NEPA process, a collaborative agreement between the Corps, Service, ENP, and SFWMD has been reached on a new alternative, IOP-Alt.7.

December 2001: The SFWMD withdrew its support for IOP-Alt. 7, citing concerns about flood control. The Corps, SFWMD, ENP, and the Service continued to refine this alternative to satisfy the SFWMD's concerns.

February 2002: The final recommended plan (IOP-Alt.7R) was discussed with DOI at a meeting between the Corps, DOI, and the SFWMD.

March 15, 2002: The Corps provided a determination that IOP-Alt.7R is "not likely to affect" the Cape Sable seaside sparrow, wood stork, and eastern indigo snake; but "slight adverse effects" would occur to the snail kite as a result of higher water levels in WCA-3A due to IOP-Alt.7R, and adverse effects would occur to the Florida panther due to loss of habitat through the construction of a proposed 500 cfs pump station (S-332C) and three seepage reservoirs associated with S-332B, C, and D pump stations. The Corps' determination with regard to the Florida panther noted that the overall ecological improvements to the Florida panther elsewhere in the project area due to IOP-Alt.7R would likely counterbalance the habitat lost in the footprint of the proposed reservoirs. Finally, the Corps requested that the Service amend the February 19, 1999, biological opinion to include IOP-Alt.7R as a second RPA to address jeopardy to the Cape Sable seaside sparrow.

BIOLOGICAL OPINION

AMENDED DESCRIPTION OF THE PROPOSED ACTION

The Corps' October 2001 Supplemental Draft Environmental Impact Statement (SDEIS) - Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow is incorporated hereby reference, as is all of the information contained in the March 15, 2002, letter and attachments to Mr. James J. Slack from Mr. James C. Duck reinitiating consultation on IOP-Alt.7R. The Central and Southern Florida (C&SF) Project is a system-wide set of canals and water-control structures located in south Florida; and it includes portions of several counties as well as portions of ENP, Big Cypress National Preserve, and adjacent areas (Figure 1). The IOP-Alt.7R project area comprises features of the Modified Water Deliveries (MWD) to ENP and the

Canal 111 (C-111) projects. The authorized MWD Project addresses Shark River Slough portion of water deliveries from the C&SF Project to ENP, while the authorized C-111 Project provides seepage control to protect natural resources associated with ENP while maintaining flood control benefits to the agricultural interests east of the L-31N/C-111 system. The primary areas in which hydrology and ecology could be affected by the alternative includes private and public lands served by the South Dade Conveyance System (SDCS), Shark River Slough, northeast Shark River Slough (NESRS), western Shark River Slough, Florida Bay portions of ENP, eastern portions of Big Cypress National Preserve, remaining privately owned lands in NESRS, and four other substantial areas of historic Everglades: Water Conservation Area (WCA)-3A, WCA-3B, WCA-2A, and WCA-2B. The project area includes some of the most significant wildlife habitat in Florida, and totals over 1.2 million acres (485,633 hectares). The IOP-Alt.7R may have additional indirect impacts on other areas of concern, including Biscayne National Park and the C-111 basin. IOP-Alt.7R consists of the following operational and structural changes to the existing C&SF Project works (Table 1; Figure 2).

The reinitiation letter indicated that several portions of IOP-Alt.7R (i.e., the raising of the northern, western, and southern levees of the existing reservoir associated with the S-332B pump station; the construction of the reservoir associated with the S-332D pump station; the full implementation of the B-C connector reservoir; and the potential for expansion of reservoirs once the boundary of ENP is amended) are likely to be phased in, depending on the outcome of a variety of efforts and considerations. These efforts and considerations include the rate of acquisition of private lands; how quickly the boundary of Everglades National Park can be adjusted; the availability of funds to construct the reservoir associated with the S-332D pump station; modeling to determine the appropriate operations of the S-332D to assist in flood control but not at the expense of the surrounding marsh condition; modeling to ascertain the operations of the S-356 pump station to control seepage; and the operational experience gained during the 2002 wet season and modeling to determine whether raising the northern, western, and southern levees of existing S-332B reservoir would compromise flood protection to a significant degree.

New Structural Features and Modifications

1. The degradation of the lower four miles of the L-67 Extension levee is proposed to allow water from northwestern Shark River Slough to flow into the northern part of Shark River Slough and northern habitat area of sparrow sub-population E. This action is expected to improve hydrologic conditions on the west side of sub-population E. Degrading a four-mile section was selected based on the results of the modeling that show a potential hydroperiod improvement in the western part of NESRS with no anticipated impact to groundwater levels in and around the 8.5 Square Mile Area.

2. The description of IOP-Alt.7R indicates that, initially, the eastern levee of the existing S-332B reservoir will be raised to six feet; however, the northern, western, and southern levees will remain at three feet until all other structural components are complete (scheduled for June 2002). However, the description attached to the reinitiation letter

further predicates this second phase of levee improvements on a decision to be made after obtaining operational experience during the 2002 wet season and further modeling efforts. This experience and modeling would determine if raising the three other levees would result in "significant" loss of flood protection. The raising of the remaining three low levees would reduce the potential of overflow in sparrow sub-population F habitat during emergency flood conditions.

3. Construction of three new reservoirs [S-332B north seepage reservoir (variously described as being 240 to 250 acres, but totaling 400 acres in conjunction with the existing reservoir associated with the S-332B pump station); the S-332C reservoir, at 300 acres; and the S-332D reservoir, at 810 acres], a new connector reservoir (the B-C connector), and one new pump station (S-332C, at 500 cfs)) is proposed consistent with the Canal 111 Project's 1994 General Design Memorandum and Environmental Impact Statement to allow higher stages in the L-31N canal, while maintaining flood control and rehydrating the marshes in Everglades National Park. The exception would be during emergency storm events as described by item number six under the *Operational Features* section. The existing S-332B reservoir (variously described as being 150 or 160 acres, but still totaling 400 acres in conjunction with the new north reservoir), combined with the three new seepage reservoirs will be nearly 10 times the size of the existing reservoir alone. This existing reservoir would remain as it is presently configured (except for raising the height of the eastern levee to six feet) until all the other structural features of IOP-Alt.7R have been constructed and are ready to operate (scheduled for the end of June 2002). With the additional seepage reservoirs and the reduction of pumping at S-332B, C, and D during periods of high water, the potential for an overflow into ENP and designated sparrow critical habitat during normal operations will be significantly reduced. This feature addresses the Service's concerns that overflows expected under ISOP and other IOP alternative operations would impact sparrow habitat in sub-populations C, F, and, possibly, D. This impact would occur directly through flooding and indirectly through import of water with nutrient levels high enough to change the vegetation composition within Cape Sable seaside sparrow habitat to a composition unsuitable for the sparrow.

4. The reservoir associated with the S-332D pump station will be constructed only if funds are available. The use of this reservoir would attenuate water pumped from S-332D into Taylor Slough as long as water levels in the reservoir are kept low enough to prevent over-flooding in the adjacent marsh habitat in sparrow sub-population C and possibly D.

5. Construction of one temporary 500-cfs pump station (S-356), to be located on an expanded portion of the L-29 levee just north of the existing S-334 pump station, to pump seepage water from the L-29 canal east of S-334 pump station into the L-29 canal west of S-334 pump station. This operation is intended to redirect seepage water from the L-31N canal north of the G-211 structure into northeast Shark River Slough via existing culverts under the Tamiami Trail (U.S. Route 41).

6. Adding an additional 30 feet (9.1 meters) to the existing S-333 spillway apron is proposed to prepare the structure for future operations when the levee system designed to protect the 8.5 Square Mile Area is built. The ecological benefit of increasing discharges at S-333 is to allow more water into NESRS. The Corps has suggested that in order to safely pass this increased flow through S-333, the existing spillway apron will need to be extended an additional 30 feet (9.1 meters).

7. Construction of the B-C connector reservoir. At a minimum, an "Offset Connector" will be constructed between the existing reservoir associated with the S-332B pump station and the proposed reservoir associated with the proposed S-332C pump station. The extent to which this offset connector can be initially constructed depends on how quickly privately owned lands in its footprint can be acquired and how expeditiously the boundary of Everglades National Park can be adjusted through a "land swap" with public lands already acquired by the South Florida Water Management District. The minimum initially constructible footprint would include lands immediately to the south (68.2 acres) of the existing reservoir associated with the S-332B pump station and the lands immediately to the north (73.1 acres) of the proposed reservoir associated with the proposed S-332C pump station. Privately owned lands between these two parcels would be excluded (Jon Moulding, Corps, personal communication 2002). These two parcels are currently owned by the South Florida Water Management District, and lie just west of the L-31N canal. One of the following three construction options for connecting reservoirs S-332B and S-332C will be chosen depending on the status of land acquisition at the time of construction:

   a. in the event the land swap has not occurred but the private parcels are acquired, a 206-acre full offset connector would be constructed.

   b. in the event the land swap occurs but the private parcels have not been acquired, a north 501.4-acre and south 563.5-acre land swap detention areas (1,064.9 acres) would be constructed.

   c. in the event the land swap occurs and the private parcels have been acquired, the land swap detention area (1,065 acres) and the full offset connector (206 acres) for a total of 1,271 acres would be constructed.

   Thus, the acreage of the B-C connector reservoir could range from 141.3 to 1,271 acres. At total build-out, the connector canal will allow water to be discharged south from the existing S-332B reservoir, thereby reducing or eliminating overflows from that reservoir benefitting sparrow habitat in sub-populations C, E, and F.

Operational Features

It is our understanding that the operations of IOP are temporary, and will be superceded by the Combined Structural and Operational Plan (CSOP), which is currently scheduled to be completed in 2005 and implemented over the following one to two years.

1. The first mode of the operational rule set of IOP-Alt.7R is designated as “No WCA-3A Regulatory Releases to SDCS or Shark Slough” operation. During these times, the L-31N canal will be maintained as high as or higher than Test 7, Phase I, levels when there are no regulatory releases from WCA-3A. These canal levels are higher than those under ISOP 2001 and other IOP alternative levels, thereby addressing concerns of the Service and ENP that maintaining the L-31N canal at ISOP levels would negatively impact ENP resources in NESRS, including designated sparrow critical habitat. These operational rules should benefit sparrow habitat in sub-populations C, D, E, and F.

2. The second set of operational rules that would apply when water is flowing from WCA-3A down and around the SDCS is called “WCA-3A Regulatory Releases to SDCS.” During this operational phase, levels in the L-31N canal would be lowered to minimize potential flood impacts in SDCS and, at the same time, provide necessary downstream gradient to move some of WCA-3A regulatory releases through S-333/S-334, down through the L-31N canal, and to the S-332B, S-332C, and S-332D pump stations. The purpose of routing regulatory releases from WCA-3A to S-332B, S-332C, and S-332D pump stations and seepage areas is to produce conditions that are biologically equivalent to the February 1999 biological opinion RPA in the habitats of sparrow sub-populations C, E, and F to provide adequate hydration to reduce the frequency of fire and prevent invasion of exotics and other woody vegetation in these habitats until the CSOP is operational.

3. S-335 will continue its primary function as a supplemental water deliveries structure with no change in operational triggers from Test 7, Phase I, of the Experimental Program of Water Deliveries, except when making S-151 regulatory releases. This operational decision will be based on first meeting the priority given to S-334 and then matching flows through S-335 with inflows from S-151 and S-337. This approach, will limit the inter-basin transfer of water south into the SDCS. The problem with the interbasin transfer is that it would require the reservoirs approved for the C-111 Project to handle more water than they were designed to accommodate, thereby not achieving the project purpose of improving conditions in ENP. Overfilling of these reservoirs would impact sparrow habitat in sub-populations C, D, and F.

4. Although not mentioned in the attachments to the reinitiation letter, it is our understanding from recent discussions among lead principals of the Corps, Jacksonville District; SFWMD; ENP; and the Service, South Florida Field Office, that operations of the S-356 pump station will be for seepage only. Furthermore, an interagency team of

hydrologic modelers will determine the pump operations needed to accommodate that amount of seepage in the short term, as well as its permanent capacity and operations in the long-term. The results will be codified by a binding agreement.

5. During non-emergency operations, all of the reservoirs would be operated at a normal maximum depth of 2.0 feet. The information included with the reinitiation letter indicates that this 2.0-foot depth applies to the S-332D reservoir; however, we understand that modeling by staff at Everglades National Park indicates that a shallower maximum depth is necessary to avoid overflooding adjacent sparrow habitat (sub-population C and possibly D). We expect this difference in modeling results to be resolved by an interagency modeling team before the S-332D reservoir is operated. If this effort concludes that a lower maximum depth during non-emergency conditions is needed to support sparrows, then the 2.0-foot depth would be changed accordingly. Similarly, operational levels in the B-C connector reservoir have not been defined. This biological opinion is predicated on the assumption that further Interagency modeling will identify operations that will provide hydropatterns that support sparrow habitat in adjacent marshes, consistent with the project purpose as defined for ENP by the 1994 Integrated General Design Memorandum and Environmental Impact Statement for the C-111 Project.

6. The Pre-storm drawdown will be the same as contained in the October 2001 IOP Supplemental Draft EIS. With the additional language:

   Operations for other than named events. SFWMD will monitor antecedent conditions, groundwater levels, canal levels, and rainfall. If these conditions indicate a strong likelihood of flooding, SFWMD will make a recommendation to the Corps to initiate pre-storm operations. The Corps will review the data, advise ENP and FWS (Fish and Wildlife Service) of the conditions, consult with the Miccosukee Tribe and make a decision whether to implement pre-storm drawdown or otherwise alter systemwide operations from those contained in the table.

   In addition, the following language will be added:

   The Chairman of the Miccosukee Tribe of Indians of South Florida or his designated representatives, will monitor the conditions in WCA-3A and other tribal lands and predicted rainfall. If the Tribe determines these conditions indicate jeopardy to the health or safety of the tribe, the Chairman will make a recommendation to the Corps to change the operations of the S-12 structures or other parts of the system. The Corps will review the data, advise appropriate agencies of the conditions, and the District Commander will personally consult with the Chairman prior to making a decision whether to implement changes to the S-12 operations.

The Service recognizes that south Florida experiences tropical systems and other strong storm events, such as the "No-Name Storm," and that these events overwhelm the infrastructure of the C&SF Project to the point that the primary purpose of management is to avoid loss of human life and to protect human safety.

Conservation Measures

Construction Monitoring Plan

Through recent discussions with the Service, the Corps has agreed to incorporate the following provisions for federally threatened and endangered species monitoring in association with IOP-Alt.7R construction activities ("Construction Monitoring Plan") into the proposed actions.

1. Monitoring for Snail Kites and Cape Sable Seaside Sparrows

For construction activities involving heavy, earth-moving equipment, sustained noise levels that make conversation difficult, blasting, or other activities having similar general disturbance potential occurring near snail kite or sparrow nesting habitat:

a. Construction will be conducted outside the species' breeding season; or

b. trained observers will survey the site beginning one month before construction is to begin, and then every two weeks thereafter, within 1.0 mile (for snail kites) or 0.25 mile (for Cape Sable seaside sparrows) from the site of construction activity. If any breeding activity is detected, all work will cease, and an intensive survey of the site will be conducted to assess the specific location, density, and stage of breeding activity. Upon completion of this survey, a meeting will be convened between the appropriate staff of the Service, Corps, ENP, SFWMD, and the FWC. Survey results will be reviewed, and, based on available information, a decision will be made on whether to continue construction at the site, continue construction with potential restrictions, or cease construction activities within the area, until nesting is completed.

c. Surveys should begin before construction crews are mobilized so as to minimize cost of delays.

2. Monitoring for Eastern Indigo Snakes

The Corps shall implement all of the standard protection measures that both agencies (Corps and Service) have agreed upon for the eastern indigo snake. The standard protection measures are listed in their entirety below:

a. An eastern indigo snake protection/education plan shall be developed by the applicant or requestor for all construction personnel to follow. The plan shall be provided to the Service for review and approval at least 30 days prior to any clearing activities. The educational materials for the plan may consist of a combination of posters, videos, pamphlets, and lectures (*e.g.*, an observer trained to identify eastern indigo snakes could use the protection/education plan to instruct construction personnel before any clearing activities occur). Informational signs should be posted throughout the construction site and contain the following information:

1. a description of the eastern indigo snake, its habits, and protection under Federal Law;

2. instructions not to injure, harm, harass or kill this species;

3. directions to cease clearing activities and allow the eastern indigo snake sufficient time to move away from the site on its own before resuming clearing; and

4. telephone numbers of pertinent agencies to be contacted if a dead eastern indigo snake is encountered. The dead specimen should be thoroughly soaked in water, then frozen.

b. If not currently authorized through an Incidental Take Statement in association with a biological opinion, only individuals who have been either authorized by a section 10(a)(1)(A) permit issued by the Service, or by the State of Florida through the FWC for such activities, are permitted to come in contact with or relocate an eastern indigo snake.

c. If necessary, eastern indigo snakes shall be held in captivity only long enough to transport them to a release site; at no time shall two snakes be kept in the same container during transportation.

d. An eastern indigo snake monitoring report must be submitted to the appropriate Florida Field Office within 60 days of the conclusion of clearing phases. The report should be submitted whether or not eastern indigo snakes are observed. The report should contain the following information:

1. any sightings of eastern indigo snakes;

2. summaries of any relocated snakes if relocation was approved for the project (*e.g.*, locations of where and when they were found and relocated);

3. other obligations required by the FWC, as stipulated in the permit.

These monitoring provisions are designed to reduce or eliminate any construction disturbance to breeding activities of listed species nearby. They will also minimize costly construction delays. The Service commends the Corps for this proactive approach to reducing possible adverse effects to listed species.

Action Area

The action area should be determined based on consideration of all direct and indirect effects of the proposed agency action [50 CFR 402.02 and 402.14(h)(2)]. For the purpose of this consultation, the Service has re-defined the action area to include the current occupied range of the panther and the snail kite in central and south Florida (Figure 4). The action area is larger than the proposed action identified by the Corps' SDEIS. The Service reviewed panther radio-telemetry data, known den sites, and other information to delineate an action area that includes lands in Charlotte, Glades, Hendry, Lee, Collier, Palm Beach, Broward, Miami-Dade, and Monroe counties, as well as the southern portion of Highlands County. Developed urban coastal areas in eastern Palm Beach, Broward, and Miami-Dade counties, and in western Charlotte, Lee, and Collier counties were excluded because they contain little to no Florida panther habitat, and it is unlikely that panthers would use such areas. The Florida Keys, in Monroe County, were excluded for the same reason.

The current range of the panther in south Florida is about one percent of its historic range that extended from eastern Texas eastward through Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, and parts of Tennessee and South Carolina. A 99 percent reduction in the historic range has not precluded the ability of individuals to move over large distances in short periods of time; therefore, potential adverse effects to individual Florida panthers in proximity to the proposed action may affect the extant population.

The original range of the snail kite was much larger than its current range. Historically, snail kites were known to nest in areas as far north as Crescent Lake and Lake Panasoffke, and as far west as the Wakulla River. The current distribution of Everglades snail kites in Florida is limited to the central and southern portions of the State. Critical habitat for the snail kite was designated in 1977 and includes: the Arthur R. Marshall Loxahatchee National Wildlife Refuge (WCA-1), WCA-2, portions of WCA-3, portions of ENP, western portions of Lake Okeechobee, the Strazzulla and Cloud Lake reservoirs in St. Lucie County, and portions of the St. Johns Marsh in Indian River County. Therefore, the proposed action may result in indirect adverse affects to a portion of snail kite range and its designated critical habitat outside the Corps' defined action area.

STATUS OF THE SPECIES/CRITICAL HABITAT

This section presents the biological and ecological information relevant to formulating the biological opinion. Appropriate information on the species' life history, habitat and distribution, and other factors necessary for survival are included. This analysis documents the effects of all past human and natural activities or events that have led to the current status of the species since those covered by the original February 19, 1999, biological opinion.

The Service has determined the following species may occur within the action area:

1. Cape Sable seaside sparrow - (E)(CH)	[*Ammodramus (=Ammospiza) maritimus mirabilis*]
2. Wood stork - (E)	(*Mycteria americana*)
3. Eastern indigo snake - (T)	(*Drymarchon corais couperi*)
4. Florida panther - (E)	[*Puma (=Felis) concolor coryi*]
5. Snail kite - (E)(CH)	(*Rostrhamus sociabilis plumbeus*)

(E) = federally listed as endangered
(T) = federally listed as threatened
(CH) = federally designated critical habitat

The individual status of the Cape Sable seaside sparrow and its critical habitat, the status of the Everglade snail kite and its critical habitat, the status of the wood stork, and the status of the eastern indigo snake have been addressed in the February 19, 1999, biological opinion. Any relevant new information on Cape Sable seaside sparrows and Everglade snail kites since the issuance of the February 1999 biological opinion has been incorporated into this amendment. Since 1999, the Service has reviewed new information on the wood stork and the eastern indigo snake and came to the conclusion that the status information has remained unchanged. The Service has become aware of increased occurrences of Florida panthers in the eastern portion of ENP in recent years, especially in terms of how the panther population as a whole interacts with the mosaic of vegetation types that occur in south Florida on a landscape level. For this reason, the February 19, 1999, biological opinion has been amended to examine the potential effects of IOP-Alt.7R on the Florida panther.

The IOP-Alt.7R would cause water levels in WCA-3A, portions of which are designated critical habitat of the snail kite, to be higher than those predicted under the original RPA; therefore, this amendment includes an evaluation of the impacts to snail kites that may utilize WCA-3A. The status of the Florida panther, Everglade snail kite and its critical habitat, and the Cape Sable seaside sparrow and its critical habitat are provided below.

Cape Sable seaside sparrow

Much of the following discussion is summarized from the MSRP (Service 1999). Other sources are referenced. A complete sparrow life history discussion can be found in the MSRP, which is incorporated by reference.

<u>Species Description</u>

The Cape Sable seaside sparrow is a medium-sized sparrow, 5 to 5.5 inches (13 to 14 cm) in length (Werner 1975). Of all the seaside sparrows, it is the lightest in color (Curnutt 1996). The dorsal surface is dark olive-grey and the tail and wings are olive-brown (Werner 1975). Adult birds are light grey to white ventrally, with dark olive grey streaks on the breast and sides. The throat is white with a dark olive-grey or black whisker on each side. Above the whisker is a white line along the lower jaw. A grey ear patch outlined by a dark line sits behind each eye. The lores of the head are yellow. The leading edge of each wing has a small yellow patch near the alula. The legs and bill are grey (Curnutt 1996). There are no noticeable differences in markings between the sexes. However, there are significant differences in the sizes of specific body parts between the sexes (Werner 1975). Young birds differ from adults in that they do not have whisker marks, lack the yellow lores, and have brown streaking on the back.

Habitat

In the 1930's, Cape Sable was the only known breeding range for the sparrow (Nicholson 1928); areas on Cape Sable that were occupied by Cape Sable seaside sparrows in the 1930's have experienced a shift in vegetative communities from freshwater vegetation to mangroves, bare mud flats, and salt-tolerant plants such as *Batis maritima* and *Borrichia frutescens* (Kushlan and Bass 1983). The hurricane of 1935 is believed to have initiated the succession of the plant community on Cape Sable from one dominated by freshwater plants to one dominated by salt-tolerant plants. Sea level rise, reduced freshwater flows to the area resulting from upstream water management practices, and another hurricane in 1960 were also likely factors in this habitat change. As a result, Cape Sable seaside sparrows no longer use this area.

The currently preferred nesting habitat of Cape Sable seaside sparrows appears to be a mixed marl prairie community that often includes muhly grass (*Muhlenbergia filipes*) (Stevenson and Anderson 1994). These short-hydroperiod, mixed marl prairies contain moderately dense, clumped grasses, with open space permitting ground movements by the sparrow. Sparrows tend to avoid tall, dense, sawgrass-dominated communities, spike rush (*Eleocharis*) marshes, extensive cattail (*Typha*) monocultures, long-hydroperiod wetlands with tall, dense vegetative cover, and sites supporting woody vegetation (Werner 1975, Bass and Kushlan 1982). Cape Sable seaside sparrows avoid sites with permanent water cover (Curnutt and Pimm 1993).

The suitability of short-hydroperiod, mixed marl prairie communities for the sparrow is driven by a combination of hydroperiod and periodic fires (Kushlan and Bass 1983). Fires prevent hardwood species from invading these communities and prevent the accretion of dead plant material, both of which decrease the suitability of these habitat for Cape Sable seaside sparrows. In the Taylor Slough area, Werner (1975) found that sparrow numbers increased annually in areas that had been burned up to three years previously. Taylor (1983) suggested that the response of sparrow population following fire is dependent on the rate of vegetation recovery, the soil depth, and the amount of exposed pinnacle rock. Taylor (1983) found that on sites where soil depth was 15.7 inches (40 cm) or greater, or on soils without pinnacle rock, vegetation recovery is rapid and the birds recovered more quickly following fire. At sites where soil depths are less than 7.9 inches (20 cm) and where considerable pinnacle rock occurs, the birds begin to reoccupy sites four years post fire (Taylor 1983). However, recent analysis suggests that a four year fire return frequency reduces habitat suitability and causes decline in resident sparrow populations (Curnutt *et al*. 1998). This recent study observed increased sparrow numbers up to at least 10 years post fire (Curnutt *et al*. 1998).

Reproduction and Demographics

Nesting has been observed from late February through early August (Service 1983). The majority of nesting occurs in the spring when large areas of the marl prairies are dry. Sparrows build new nests for each successive brood. The average height of the nests (i.e., from soil surface to bottom of the nest structure) increases after the onset of summer rains in early June (Lockwood *et al*. 2001). Nests that hatch young before June 1st sit an average of 6.7 inches (17 cm) off the ground, whereas nests that hatch young after June 1st sit an average of 8.3 inches (21 cm) off the ground (Lockwood *et al*. 2001). Similarly, average nest height varies from year to year. Lockwood *et al*. (2001) determined that during the 1996 and 1997 breeding seasons, Cape Sable seaside sparrows built nests closer to the ground (6.3 inches and 5.9 inches respectively) than during the 1998 and 1999 breeding season (8.3 inches and 7.5 inches respectively). Sparrows construct their nests with materials that are locally common and sometimes place taller grasses over the nest to conceal it. Nests are placed in clumps of grasses composed primarily of *Muhlenbergia* and *Spartina* (Pimm *et al*. 1996).

Pimm (University of Tennessee, personal communication 1996) suggests that nesting will not be initiated if water levels are at a depth greater than 3.9 inches (10 cm) during the breeding season. The end of the breeding season appears to be triggered by the onset of the summer rains. When water levels rise above the mean height of the nests off the ground, sparrows cease breeding (Lockwood *et al*. 1997).

Cape Sable seaside sparrows usually raise one or two broods in a season, although they may raise a third brood if weather conditions allow (Kushlan *et al*. 1982, Service 1983). Recent information indicates sparrows can produce up to four broods if conditions allow (Lockwood *et al*. 2001).

A draft report by Pimm and Bass (2000) indicates that the survivability of male sparrows may not have been as low as previously assumed. This draft report estimates that only 34 percent of the males are lost from the population, "even under the best conditions," and that a maximum of 66 percent of the males survive from year to year. Survivorship of females and first-year birds are inferred, but no direct observations have been provided. While this information is encouraging, we do not yet have sufficient information to change the outcome of our biological analysis. Furthermore, we remain concerned that population levels in sub-population A remain depressed, a condition that indicates that it is not experiencing the "best conditions" mentioned in the draft report.

Foraging

Cape Sable seaside sparrows typically forage by gleaning items from low vegetation or from the substrate (Ehrlich *et al*. 1992). The sparrow is a dietary generalist (Pimm *et al*. 1996). They commonly feed on soft-bodied insects such as grasshoppers, spiders, moths, caterpillars, beetles, dragonflies, wasps, marine worms, shrimp, grass, and sedge seeds (Stevenson and Anderson 1994). Significant differences were detected in nestling diet between years and sites (Lockwood *et al*. 1997), which reflects the patchy distribution of insects and opportunistic nature of the sparrow (Post and Greenlaw 1994). The sparrow appears to shift the importance of prey items in its diet in response to their availability (Pimm *et al*. 1996).

Movements

The Cape Sable seaside sparrow is nonmigratory. The fidelity of breeding male sparrows to their territories is high; many male seaside sparrows will defend the same area for two to three years (Werner 1975). Lockwood *et al*. (2001) followed banded individuals from one breeding season to the next and found that adult sparrows move an average of 695.5 feet (212 m) from the location where they were banded the previous year (or in some cases, two or more years previously). An average movement of 695.5 feet (212 m) means that many birds probably do not move their territories from one year to the next and the majority only adjust their positions (Lockwood *et al*. 2001).

Dean and Morrison (1998) utilized radio-transmitters to document sparrow movements over the non-breeding season within the western population (sub-population B). Of the 17 individuals for which they recorded over 20 locations, all but two made movements >1,214 feet (>370 m)(Dean and Morrison 1998). Longer-range movements were recorded, sometimes up to 4.3 miles (7 km). These movements were rare, however, and these individuals returned to their breeding territories by the end of the non-breeding season (Dean and Morrison 1998). Collectively, these observations indicate that adult sparrows are quite sedentary throughout the year. Adult immigration and emigration rates are low.

Lockwood *et al*. (2001) resighted or recaptured juveniles an average of 1,893 feet (577 m) from their place of hatching. This value is significantly different from that observed for equivalent time frames in adults and is in contrast to adult dispersal distances (Lockwood *et al*. 2001). Juvenile birds are more apt to move longer distances with a maximum recorded natal dispersal distance of over 3,281 feet (1 km)(Lockwood *et al*. 2001).

Status and Distribution

The Cape Sable seaside sparrow was listed as an endangered species on March 11, 1967, pursuant to the Endangered Species Preservation Act of 1966 (32 FR 4001). That protection was continued under the Endangered Species Conservation Act of 1969 and the Endangered Species Act of 1973, as amended. The Cape Sable seaside sparrow was listed because of its limited distribution and threats to its habitat posed by large-scale conversion of land in southern Florida to agricultural uses. Critical habitat for the Cape Sable seaside sparrow was designated on August 11, 1977 (50 CFR § 17.95)(42 FR 40685), before the full distribution of the subspecies was known (Figure 5). The critical habitat, as designated, does not adequately account for the distribution of the present-day core sub-populations, or the areas necessary for continued survival and recovery. An important area west of Shark River Slough, which until 1993 supported one of two core sub-populations (nearly half of the entire population), is not included within designation, and has been undergoing detrimental changes in habitat structure as a result of water management practices. Additionally, other parts of the designated critical habitat have been converted to agriculture, and are no longer occupied by sparrows.

The results of several studies suggest that Cape Sable seaside sparrows exist as several sub-populations whose distribution, size, and importance to the persistence of the species changes with time. Bass and Kushlan (1982) described two core sub-populations of the sparrow, one northwest of Shark River Slough in the southeast portion of the Big Cypress National Preserve (sub-population A), and a second one in the Taylor Slough area southeast of Shark River Slough (sub-population B). Curnutt and Pimm (1993) recognized six sub-populations (A-F) of the Cape Sable seaside sparrow that roughly correspond to the groupings recognized by Bass and Kushlan in 1982 (Figure 5). Pimm (1998) suggested that three breeding sub-populations are critical to the long-term survival of the Cape Sable seaside sparrow.

In 1981, Bass and Kushlan (1982) estimated a total of 6,656 birds in the six sub-populations; two core sub-populations (A and B) that held most of the sparrows, and four peripheral sub-populations (C-F). Core sub-population A inhabited the marl prairies west of Shark River Slough extending into Big Cypress National Preserve and held an estimated 2,688 individuals. Core sub-population B held approximately 2,352 birds inhabiting the marl prairies southeast of Shark River Slough near the center of ENP. Peripheral sub-population E, north of sub-population B, held about 672 sparrows, while sub-population C, located along the eastern boundary of ENP, and sub-population D, just to the southeast of sub-population C, held about 400 birds each. Peripheral sub-population F, the northernmost peripheral sub-population located on the western edge of the Atlantic coastal ridge, was the smallest sub-population with an estimated 112 birds. Bass repeated the survey in 1992, with population estimates similar to those in 1981.

Table 2 presents the results of the last 12 censuses of the Cape Sable seaside sparrow. The actual number of birds observed is corrected to give an estimate for the total population using the methods developed by Bass and Kushlan (1982). Logistical problems resulted in incomplete surveys in 1994.

In 1981 and 1992, the area west of Shark River Slough (sub-population A) supported nearly half of the total Cape Sable seaside sparrow population. Starting in 1993, the number of individuals declined precipitously in this area. By 1994 and 1995, the birds were absent from this area except for a few locations and the number of individuals had dropped to less than 10 percent of

1992 numbers. Population estimates improved slightly during the 1996 breeding season as the numbers of sparrows found west of Shark River Slough increased from approximately 240 in 1995 to 384 birds in 1996. The 1997 and 1998 estimates indicate a continued decline of individuals within sub-population A (272 and 192 birds respectively). In 1999 and 2000, the number of individuals more than doubled compared to the 1998 survey results. However, in 2001, the total number of birds west of Shark River Slough declined once again to approximately 128 individuals. Sub-population A estimates for 2001 are less than 5 percent of what they once were in 1992.

Core sub-population B increased by more than 800 birds from 1981 to 1992, declined slightly from 1992 to 1995, remained relatively stable from 1995 to 1997, and decreased by approximately 1,000 individuals in 1998. Interestingly, from 1999 to 2001 population estimates have remained stable in this core sub-population. Sub-population B remains one of the most abundant populations, with numbers changing only slightly from previous years.

Sub-population C declined to 11 percent of its 1981 value by 1992. After three years of no birds, 48 birds were estimated in this area in 1996 and 1997 and 80 birds were estimated in 1998. Since 1998, this population has remained stable through the 2001 surveys (approximately 96 birds).

Sub-population D declined from 1981 to 1993 (400 to 93 birds respectively), and was not counted in 1994. No birds were found in 1995, but 80 birds were estimated in this area in 1996, and 48 in 1997 and 1998. In 1999, the population grew to an estimated 176 birds. Unfortunately, numbers have been decreasing since 1999 with 32 birds estimated in 2001.

Sub-population E decreased little between 1981 and 1992, fluctuated in the mid 1990's and increased to an estimated 912 birds in 1998. Numbers have remained stable since 1998 with the 2001 survey estimating 848 birds.

By 1992, Sub-population F declined to 29 percent of the 1981 estimation. No sparrows were observed in 1993 and no counts occurred in 1994. Surveys resumed in 1995, but no sparrows were observed. From 1996 to 1999, only 16 birds were estimated for each year. The next year (2000) the population increased to an estimated 112 birds; but in 2001, the numbers decreased to 32 estimated birds.

The most recent survey (2001) indicates that Cape Sable seaside sparrows have declined almost 50 percent range-wide since 1992. However, the range-wide population estimates have remained relatively stable since 1993, with the greatest abundance estimate occurring in 1997 (4,048 estimated birds).

Recovery Plan Objective

Pursuant to the MSRP (Service 1999), to achieve downlisting the following criteria must be met: if the loss of functional Cape Sable seaside sparrow habitat, as a result of current and past water management practices, and the invasion of woody and exotic plant species, is eliminated; if Cape Sable seaside sparrow habitat west of Shark River Slough and in Taylor Slough, which has been degraded by current and past water management practices, is restored; when demographic information on the Cape Sable seaside sparrow supports, for a minimum of five years, a probability of persistence [$T_{(N)}$] that is equal to or greater than 80 percent (+/- 0.05), for a minimum of 100 years; when the rate of increase (r) for the total population is equal to or greater than 0.0 as a three year running average for at least 10 years; when a minimum of three stable, self-sustaining core breeding areas are secured; when a stable age structure is achieved in the core populations; and, when a minimum population of 6,600 birds is sustained for an average of five years, with all fluctuations occurring above this level.

Florida panther

Much of the following discussion is summarized from the MSRP (Service 1999); a complete panther life-history discussion can be found in that document, which is incorporated by reference. The reader should be aware that most of the life history studies were completed in the 1980s and early 1990s prior to genetic restoration, and concentrate on Florida panthers in southwest Florida. Current research efforts are focused primarily on monitoring the status and progress of genetic restoration efforts.

Species Description

The panther is a medium-sized subspecies of puma or mountain lion that is characterized as being relatively dark tawny in color, with short, stiff hair (Bangs 1899), and relatively longer legs and smaller feet (Cory 1896) than other subspecies. Skulls of the panther have been described as having a broad, flat, frontal region, and broad, high-arched or upward-expanded nasals (Young and Goldman 1946).

The coat of adult panthers is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. The long cylindrical tail is relatively slender compared to some of the other subspecies (Belden 1988). Panther kittens are gray with dark brown or blackish spots and have five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable by the time they are six months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988).

Panthers in southwest Florida often exhibit three external characters that are not found in combination in other subspecies of *P. concolor*. These characters are: (1) a right-angle crook at the terminal end of the tail, (2) a whorl of hair or “cowlick” in the middle of the back, and (3) irregular, light flecking on the head, nape, and shoulders (Belden 1986). The light flecking may be a result of scarring from tick bites (Maehr 1992a).

Adult male panthers reach a length of around 7 feet (2.15 meters) from the nose to the tip of their tail and have reached or exceeded 150 pounds (68 kilograms) in weight, but typically average around 120 pounds (54.5 kilograms). They stand approximately 23 to 27 inches (60 to 70 centimeters) at the shoulder. Female panthers are considerably smaller, with an average weight of around 75 pounds (34 kilograms) and average length of about 6 feet (1.85 meters).

Habitat

Maehr (1990a) estimated the current occupied range of the panther to be 2.2 million acres (890,000 hectares) in south Florida. Native landscapes within the Big Cypress Swamp region of south Florida, within occupied panther range, are dominated by slash pine (*Pinus elliottii*), cypress, and freshwater marshes, interspersed with mixed-swamp forests, hammock forests, and prairies (Duever *et al.* 1979). Private lands represent about 50 percent of occupied panther range in south Florida. The largest contiguous tract of panther habitat is the Big Cypress National Preserve/Everglades ecosystem in Collier, Monroe, and Miami-Dade counties. Suitable habitat extends into Lee, Hendry, Charlotte, Glades, Broward, Palm Beach, and southern Highlands counties. Poorer-quality (low nutrient, frequently saturated) soils prevalent south of Interstate 75 in south Florida do not produce the quality or quantity of forage required to support large herds of deer and other panther prey items. The influence of soils on primary productivity makes it unlikely that habitat in Big Cypress National Preserve and ENP is as productive as habitat on private lands in northern and western Collier County in terms of panther health, reproduction, and density. Better soils and drainage also make private lands north of Interstate 75 more suitable for intensive agriculture and urban growth (Maehr 1992a).

Native upland forests are preferred by panthers in southwest Florida (Maehr 1990a), although McBride (Roy T. McBride, personal communication, 2001) hypothesizes that understory cover may also be a key factor in panther habitat use. Highly preferred habitat types are relatively limited in availability but are sought by panthers as daytime resting cover (Maehr *et al.* 1991a). Understory thickets of saw palmetto have been identified as the most important resting and denning cover for panthers (Maehr 1990a). Early telemetry investigations ($n = 6$) indicate that panther use of mixed swamp forests and hammock forests was greater than expected relative to their availability within the panthers' home range (Belden *et al.* 1988). As investigations expanded onto private lands between 1985 and 1990, it was determined that panthers preferred native upland forests, especially hardwood hammocks and pine flatwoods, over wetlands and disturbed habitats ($n = 26$) (Maehr *et al.* 1991a). Hardwood hammocks were consistently preferred by panthers, followed by pine flatwoods (Maehr *et al.* 1991a). This may be related to the fact that, among major vegetation types in Florida, hardwood hammocks had the greatest potential for producing important panther prey species such as the white-tailed deer (*Odocoileus virginianus*), feral hog (*Sus scrofa*), and raccoon (*Procyon lotor*) (Harlow 1959, Belden *et al.* 1988, Maehr 1990a, Maehr 1992a, Maehr *et al.* 1991a).

Male panthers use more cover types and have larger home ranges than do females. The home range size of male panthers is influenced by the percentage of hardwood hammock, hardwood swamp, water, grass, agricultural land, barren land, scrub, and brush in the landscape. Smaller male home ranges have greater percentages of hardwood hammocks and hardwood swamp, while larger home ranges have greater percentages of water, grass and agricultural land, barren land, shrub, and brush. Larger female home range size has been positively correlated with higher percentages of dry prairie, shrub swamp, and shrub and brush (Maehr 1992b). Similar to male home range size, female panther home range size is inversely related to habitat quality, which may also influence reproductive success (Maehr 1992b, Maehr *et al.* 1989a).

Dispersing males may wander widely through unforested and disturbed areas. Agricultural and other disturbed habitats, freshwater marsh, thicket swamp, and mixed swamp are not preferred, and are either used in proportion to their availability or are avoided (Maehr 1990a). Habitats avoided by panthers include agriculture, barren land, shrub and brush, and dry prairie. Panthers have not been found in pastures during daytime telemetry location flights but may travel through them at night (Maehr 1992a, Maehr *et al.* 1991a).

Telemetry research is biased toward heavily forested public lands where a majority of panthers have been captured and radio-collared. Telemetry data are collected just after sunrise and at a time when panthers are bedding down for the day. Other panther activities must be interpreted from the location of the telemetry reading in the landscape and from field investigations. Consequently the value of habitats characterized as "not preferred" or "avoided" is understated.

Habitats characterized as "not preferred" and "avoided" provide food and cover for panther prey, provide a buffer against more intensive land uses such as urban development, have a capacity to be restored to a native condition more conducive to panther use, and are part of the rural landscape matrix that has allowed the panther to persist in south Florida. Panthers also utilize low cover to approach within striking distance of prey and capture the prey after a short, high-speed rush from a concealed position (McBride 1976) and have recently been documented denning in sawgrass (*Cladium jamaicense*) (Land *et al.* 2001).

Life History

Panthers are essentially solitary. Interactions between panthers were infrequent during a 1985-1990 study. Most interactions occurred between adult females and their kittens. Interactions between adult male and female panthers were second in frequency. Interactions between males and females lasted from one to seven days and usually resulted in pregnancy. Documented interactions between males were not uncommon and resulted in serious injury or death to some individuals. Aggressive encounters between females have not been documented (Maehr *et al.* 1991a).

Reproduction and Demography

The pattern of Florida panther distribution involves several males maintaining large, mutually exclusive home ranges containing several adult females and their dependent offspring. This spatial arrangement seems to be a prerequisite for successful reproduction (Maehr 1993). Male panthers are polygynous. Breeding activity peaks in fall and winter (Maehr 1992a). Parturition is distributed throughout the year with 81 percent of births occurring between March and July. Litter sizes range from one to four kittens, with a mean of 2.2 kittens per successful litter[1] (Maehr *et al.* 1991a). Intervals between litters range from 16 to 37 months.

Den sites are usually located in dense, understory vegetation, typically saw palmetto (*Serenoa repens*) (Maehr 1990a). Two panther dens recently documented in sawgrass (Land *et al.* 2001) illustrate an exception to the norm. Den sites are used for up to two months by female panthers and their litters from parturition to weaning, and are also used in subsequent years. Female panthers losing their litters generally produce replacement litters. Five of seven females whose kittens were brought into the captive breeding program successfully reproduced an average of 10.4 months after the removal of the litter (Land 1994).

Early estimates of infant mortality varied and were in conflict. For example, Roelke *et al.* (1993) characterized infant mortality as relatively high with fewer than half of all births resulting in offspring that survive beyond six months of age (Roelke *et al.* 1993). Land (1994) estimated the kitten survival rate between age six months and one year at 0.895, based on a sample of 15 radio-instrumented kittens monitored from six months to one year of age.

Age at first reproduction has been documented at 18 months for females (Maehr *et al.* 1989b). The first sexual encounters for males has occurred at approximately three years of age (Maehr *et al.* 1991a). Dispersal of young typically occurs around 1.5 to two years of age, but may occur as early as one year of age (Maehr 1992a). Young panthers are considered recruited into the population when they have successfully reproduced (Dennis Jordan, Service, personal communication, 1997).

Females are readily recruited into the population as soon as they are capable of breeding (Maehr *et al.* 1991a). Males appear to have more difficulty being recruited. Sub-adult male recruitment is complicated by the lack of dispersal habitat and competition with adult male panthers for territories. Without large areas of suitable habitat to accommodate dispersal, young males have few opportunities for recruitment as residents. As a result, the panther's ability to increase and outbreed has been severely restricted. Successful male recruitment appears to depend on the death or home range shift of a resident adult male (Maehr *et al.* 1991a). Turnover in the breeding population is low; documented mortality in radio-collared Florida panthers is greatest in sub-adult and non-resident males (Maehr *et al.* 1991b).

---

[1] A successful litter is one in which the kittens have survived to an age of at least six months.

Foraging

Food habit studies of panthers in southwest Florida indicate that the feral hog is the most commonly taken prey, followed by white-tailed deer, raccoon, and nine-banded armadillo (*Dasypus novemcinctus*). Deer and hogs accounted for 85.7 percent of consumed biomass north of Interstate 75 and 66.1 percent south of Interstate 75 (Maehr 1990a). No seasonal variation in diet was detected; however, panthers inhabiting an area of better soils consumed more large prey. Differences in prey abundance and availability were indicated by an eight-fold greater deer abundance north of Interstate 75 versus south of Interstate 75, although the estimated number of deer consumed did not differ between the north and south portions of the study area. Hog numbers were lower south of Interstate 75. Fewer large prey may, in part, explain the poorer physical condition, larger home ranges, and lower reproductive output of panthers south of Interstate 75. Hogs dominated the diet of panthers in the north in terms of both estimated biomass and numbers. In the south, deer accounted for the greatest estimated biomass consumed, whereas raccoons were the highest estimated number of prey items consumed. Domestic livestock were found infrequently in scats or kills, although cattle were readily available north of Interstate 75 (Maehr *et al.* 1990a).

Movements and Dispersal

Adult panthers occupy available habitat in southwest Florida in a pattern similar to that of western cougars (Land 1994). Over 7,000 telemetry locations on 26 radio-collared panthers between 1985 and 1990 indicated that home-range size varied from 21 to 461 square miles (53 to 1,183 square kilometers), averaging 200 square miles (519 square kilometers) for resident males and 75 square miles (193 square kilometers) for resident females. Home ranges of resident adults were stable unless influenced by the death of other residents. Home-range overlap was extensive among resident females and limited among resident males (Maehr *et al.* 1991a).

Dispersal distances average 36.4 miles (58.7 kilometers) for sub-adult males and 9.9 miles (16 kilometers) for an adult female. Mean dispersal age was 17.9 months. Dispersing males wander widely through unforested and disturbed areas (Maehr 1992a). The limited dispersal opportunities for sub-adult males may encourage fighting among males (Maehr *et al.* 1991a).

Activity levels for panthers peak around sunrise and sunset. The lowest activity levels occur during the middle of the day. Females at natal dens follow a similar pattern with less difference between high and low activity periods. Although some travel occurs during the day, panthers are mostly nocturnal (Maehr *et al.* 1990b).

There are no known differences in seasonal movements, wet and dry season habitat use, seasonal variation in diet, or effects of season on road crossings. There may be a response to fluctuations in water levels; however, the response is believed to be unmeasurable (Maehr 1989; Maehr *et al.* 1990b, 1991a).

Relationship to Other Species

The panther requires extensive, biotically diverse landscapes to survive. Large carnivores are considered critical in maintaining ecological integrity in many large forested systems (Terborgh 1988). Landscapes through which the panther ranges support a vast array of south Florida's faunal and floral diversity. The panther's most important species association is with its prey species. Deer, hog, and raccoon are the most important prey species taken in term of biomass and numbers (Maehr *et al.* 1990a). Comparisons of food habits, habitat use, and movements revealed a low probability for competitive interactions among the panther, bobcat (*Lynx rufus*), and Florida black bear (*Ursus americanus floridanus*). All three species preferred upland forests but consumed different foods and utilized the landscape in ways that resulted in ecological separation (Maehr 1997).

Status and Distribution

The Florida panther was listed as endangered in 1967 (32 FR 4001); however, no critical habitat has been designated for the panther. The Florida population may have numbered as many as 500 at the turn of the century (Seal *et al.* 1989). Historically, the panther was distributed from eastern Texas or western Louisiana and the lower Mississippi River valley east through the southeastern States in general, intergrading to the north with *P. c. cougar*, and to the west and northwest with *P. c. stanleyana* and *P. c. hippolestes* (Young and Goldman 1946) (Figure 7). The first bounty on Florida panthers was passed in 1832. Another Florida law passed in 1887 authorized a payment of $5.00 for panther scalps (Tinsley 1970). Hunting, habitat loss, and reduced prey availability have led to the decline of this species since that time (Belden *et al.* 1988, Maehr 1992a).

The State of Florida declared the panther a game species in 1950 and an endangered species in 1958. The population was estimated at 100 to 300 statewide in 1966 (Smith 1970, Schemnitz 1972). The Federal government listed panthers as endangered in 1967. The Service cited heavy hunting and trapping pressures, an inability to adapt to changes in the environment, and developmental pressures as the reasons for the decline of the panther (Service 1967). The Florida Panther Act, a State law enacted in 1978, made killing the panther a felony.

The Big Cypress population was estimated at 125 in 1969 (DOI 1969), and a south Florida population at 92 in 1972 (Schemnitz 1972). In the 1970s, the Florida Game and Fresh Water Fish Commission (the predecessor of the FWC) established a Florida Panther Record Clearinghouse to ascertain the status of the panther. The first field searches were made in 1972. Telemetry investigations began in 1981, primarily on public lands in southwest Florida. Maehr *et al.* (1991a) estimated the density of panthers in southwest Florida between February and July 1990 to be one panther per 42.9 square miles (110 square kilometers). When extrapolated over a 1,965.6 square-mile (5,040 square-kilometer) area thought to be occupied by radio-instrumented panthers in southwest Florida, the estimated population of the area was 46 adults (9 resident males, 28 resident females, and 9 transient males) between December 1985 and October 1990.

This population estimate assumed homogeneous density and similar age and sex composition over time and space. The total population in south Florida was likely higher, because the estimation technique excluded panthers in ENP, eastern Big Cypress National Preserve, and areas north of the Caloosahatchee River (Maehr *et al.* 1991a). Logan *et al.* (1993) reports that based on road kills, tracks, scat, and a decade of radio telemetry data, the only reproducing panther population occurs in Collier, Miami-Dade, Hendry, and Lee counties in south Florida.

The Florida Panther Interagency Committee, based on data collected from 1981 through 1991 by the Florida Game and Fresh Water Fish Commission and NPS, estimated the population at 30 to 50 adult panthers (Logan et al. 1993). Early population viability analyses projected extinction of the panther in 25 to 40 years under existing demographic and genetic conditions (Seal *et al.* 1989, 1992). The extant population is currently estimated at 78 (Roy T. McBride, personal communication, 2001). This number is 28 more than the 50 that the best currently available scientific information (Seal et al. 1989) indicates are needed to ensure demographic and genetic health in the extant population.

Of the 27 recognized subspecies of *P. concolor* described by Hall (1981), the Florida panther is the sole remaining subspecies in the eastern United States. The panther presently occupies a contiguous system of native uplands and wetlands, agricultural lands including rangeland, and rural areas totaling about 2.2 million acres (890,000 hectares) on public and private lands in Charlotte, Glades, Lee, Hendry, Collier, Miami-Dade, Broward, Palm Beach, Monroe, and Highlands counties in south Florida (Maehr 1990a).

Geographic isolation, habitat loss, small population size, and associated inbreeding have resulted in the loss of approximately half of the panther's genetic diversity (Roelke 1990). Land *et al.* (2001) indicate that representation of Texas cougar genes in the southern Florida population is probably close to the goal of 20 percent, although two of the eight Texas females are over-represented. The occurrence of kinked tails and cowlicks has been reduced in intercross progeny. Information on other morphological traits associated with genetic isolation and inbreeding such as cryptorchidism, sperm deformities, atrial septal heart defects, and skull morphology cannot be collected until the intercross progeny mature or pass away. On the other hand, the fecundity of the intercross progeny would seem to indicate that sperm deformities have been reduced. For example, one first-generation male captured and examined in the field by Smithsonian theriogenologist Dr. Jo Gayle Howard had a sperm count three times that of a Florida panther, a sperm motility rate that was twice as high, a percentage of normal sperm that was four times greater, and a sperm concentration that was ten times higher (Roy T. McBride, personal communication, 2001). Since the genetic restoration program was initiated in 1995, the number of panthers censused annually has increased, highway mortality has increased, and panthers have moved into formerly unoccupied niches on public land in south Florida. These are indications of a robust population that vary dramatically from population parameters prior to 1995. Florida panther and Texas cougar kitten survival to six months is currently estimated at 52 and 72 percent, respectively, and the average at 62 percent (Land *et al.* 2001).

The number of radio-collared panthers being monitored has increased from 8 in 1984 to 46 in 2001 (Land *et al.* 2001). There are currently 7 documented panthers in the ENP population nearest the proposed project area, 5 females and 2 males (Oron "Sonny" Bass, personal communication, 2001). Throughout the occupied range of the panther, the ENP population represents at least 11 percent of the panther population known to the Service. Bass (personal communication, 2001) further stated that two panthers in ENP have been documented crossing the Shark River Slough into Big Cypress National Preserve. The Geographic Information System database at the South Florida Field Office in Vero Beach indicates that five radio-collared panthers (numbers 16, 61, 23, 27, and 85) have been recorded on or near the sites of the proposed reservoirs. These telemetry data indicate that this area is on the easternmost edge of occupied panther habitat. Currently, the only live panthers that have been recorded in this area are numbers 61 (a female) and 85 (her male offspring). An uncollared individual of unknown status has also recently been seen nearby in the company of number 61 (Roy T. McBride, personal communication, 2001; Oron "Sonny" Bass, ENP, personal communication, 2001).

Recovery Plan Objective

Population viability analysis data indicate that a minimum of 50 adult panthers is needed to ensure demographic and/or genetic health (Seal *et al.* 1989). The present population is estimated at 78 panthers (Roy T. McBride, personal communication, 2001) following implementation of a genetic restoration program. Maehr (1990a) hypothesized that there was no unoccupied habitat suitable for dispersal by sub-adult panthers; however, with the recent population increase panthers are expanding into previously unoccupied or underutilized areas such as southern Big Cypress National Preserve.

A recent population viability analysis using a non-spatially explicit model known as VORTEX indicates a high probability of persistence for 100 years (Maehr *et al.* 1999), but concerns about model assumptions and data limitations make application of these results problematic. As a result, the Service has convened a panel of scientists tasked with completing a population viability analysis using a spatially explicit model known as RAMAS and updated demographic parameters. The results will then be used to better guide recovery and regulatory decisions.

Snail Kite

Much of the following discussion is summarized from the MSRP (Service 1999). Other sources are referenced. A complete snail kite life history discussion can be found in the MSRP, which is incorporated by reference.

Species Description

The snail kite is a medium-sized raptor, with a total body length for adult birds of 14 to 15.5 inches (36 to 39.5 cm) and a wingspan of 42.5 to 45 inches (109 to 116 cm) (Sykes *et al.* 1995). In both sexes, the tail is square-tipped with a distinctive white base, and the wings are broad and paddle-shaped. Adults of both sexes have red eyes, while juveniles have brown eyes (Brown and Amadon 1976, Clark and Wheeler 1987). The slender decurved bill is an adaption for extracting the kite's primary prey, the apple snail; the bill is a distinguished character for field identification in both adults and juveniles.

Sexual dimorphism is exhibited in this species, with adult males uniformly slate gray and adult females brown with cream streaking in the face, throat, and breast. Most adult females have a cream superciliary line and cream chin and throat (Sykes *et al*. 1995). Females are slightly larger than males. Immature snail kites are similar to adult females but are more cinnamon-colored, with tawny or buff-colored streaking rather than cream streaking. The legs and cere of females and juveniles are yellow to orange; those of adult males are orange, turning more reddish during breeding (Sykes *et al*. 1995).

In the field, the snail kite could be confused with the norther harrier (*Circus cyaneus*), a similarly sized hawk with a white rump. The norther harrier has a longer and narrower tail, with longer narrower wings held in a dihedral. The snail kite's flight is slower and characterized by more wing flapping, with the head tilting down to look for snails; the norther harrier has a gliding, tilting flight. At a closer distance, the long, curved beak of the snail kite allows it to be easily distinguished from the norther harrier (Sykes *et al*. 1995).

<u>Habitat</u>

Snail kite habitat consists of freshwater marshes and the shallow vegetated edges of lakes (natural and man-made) where apple snails (*Pomacea pallidosa*) can be found. Suitable foraging habitat for the snail kite is typically a combination of low-profile ($\leq$10 feet) marsh with a matrix of shallow (0.65 - 4.25 feet deep) open water that is relatively clear and calm. Low trees and shrubs are also often interspersed with the marsh and open water. Snail kites require foraging areas to be relatively clear and open in order to visually search for apple snails; therefore, dense growth of herbaceous or woody vegetation is not conducive to efficient foraging. Nearly continuous flooding of wetlands for $\geq$1 year is needed to support apple snail populations that in turn provide forage for the snail kite (Beissinger 1988).

Nesting and roosting sites almost always occur over water, which deters predation. Nesting substrates include small trees (usually < 32.8 feet in height), but can also occur in herbaceous vegetation, such as sawgrass, cattail, bulrush, and reed (Service 1999). It is important to note that suitable nesting substrate must be close to suitable foraging habitat, so extensive areas of contiguous woody vegetation are generally unsuitable for nesting.

<u>Reproduction</u>

Copulation can occur from early stages of nest construction, through egg laying, and during early incubation if the clutch is not complete. Egg laying begins soon after completion of the nest or is delayed a week or more. In Florida, the incubation period lasts from 24 to 30 days (Sykes 1987a).

Hatching success is variable from year to year and between areas. In nests where more than one egg hatched, hatching success averaged 2.3 chicks per nest. The most successful months for hatching are February (19 percent), March (31 percent), and April (23 percent) (Sykes 1987a).

The breeding season varies widely from year to year in relation to rainfall and water levels. Ninety-eight percent of the nesting attempts are initiated from December through July, while 89 percent are initiated from January through June (Sykes 1987a, Beissinger 1988).

Foraging

The snail kite feeds almost exclusively on apple snails in Florida (Sykes 1987b). Snail kites spend between 25 to 50 percent of the time foraging while nesting, and 31 to 68 percent of the time foraging during pre- and post-nest desertion periods (Service 1999). Feeding perches include living and dead woody-stemmed plants, blades of sawgrass and cattails, and fence posts.

Movements

Snail kites in Florida are not migratory in the strict sense; they are restricted to southern and central Florida. Snail kites are nomadic in response to water depths, hydroperiod, food availability, nutrient loads, and other habitat changes (Bennetts *et al.* 1994). Radio-tracking and sighting of marked individuals have revealed that nonbreeding individuals disperse widely on a frequent basis (Bennetts *et al.* 1994). Shifts in distribution can be short term, seasonal, or long-term; and can take place between areas among years (Rodgers *et al.* 1988), between areas within a given nesting season (Beissinger 1986), within areas in a given nesting season, and within or between areas for several days to a few weeks (Bennetts and Kitchens 1997a). Sykes (1983b) noted that during colder winters, snail kites will shift their distribution more to the southern part of their range. More information on movement responses in reaction to habitat alteration due to human intervention is discussed below.

Status and Distribution

The snail kite was federally listed as endangered in 1967 [see FR 42(155): 40685-40688] because of its limited distribution and threats to its habitat posed by large-scale conversion of land in southern Florida to agricultural uses. Critical habitat (Figure 8) was designated for the snail kite in 1977 and has not been revised since then. Critical habitat includes portions of the WCAs, portions of ENP, western portions of Lake Okeechobee, the Strazzulla and Cloud Lake reservoirs in St. Lucie County, and portions of the St. Johns Marsh in Indian River County. A complete description of the critical habitat is available in 50 CFR §17.95. Although the critical habitat that was designated for the snail kite did not include constituent elements, water-level management as discussed below is required to maintain favorable habitat conditions that are considered necessary to ensure the species survival.

Several authors (Nicholson 1926, Howell, 1932, Bent 1937) indicated that the snail kite was numerous in central and south Florida marshes during the early 1900s, with groups of up to 100 birds. Sprunt (1945) estimated the population to be 50 to 100 individuals. The snail kite apparently plummeted to its lowest population between 1950 and 1965. By 1954, the population was estimated at no more than 50 to 75 birds (Sprunt 1954). Stieglitz and Thompson (1967) reported 8 birds in 1963 at the Loxahatchee National Wildlife Refuge, 17 on the refuge and 2 at Lake Okeechobee in 1964, 8 in WCA-2A and 2 on Lake Okeechobee in 1965, and 21 in WCA-2A in 1966. On the other hand, no snail kites have been observed nesting within the Lake Okeechobee littoral zone over the past few years, due to loss of nesting substrate (Steve Gornak, FWC, personal communication, 2001).

The snail kite has apparently experienced population fluctuations associated with hydrologic influences, both man-induced and natural (Sykes 1983b, Beissinger 1986), but the amount of fluctuation is debated. While acknowledging the problems associated with making year-to-year comparisons in the count data, some general conclusions are apparent. Lake Okeechobee apparently can retain some suitable snail kite habitat throughout both wet and dry years, as long as water levels do not compromise nesting substrate. In contrast, kite use of WCA-3A fluctuates greatly, with low use during drought years, such as 1991, and high use in wet years, such as 1994. Although sharp declines have occurred in the counts since 1969 (for example, 1981, 1985, 1987), it is unknown to what extent this reflects actual changes in the population. Rodgers *et al.* (1988) point out that it is unknown whether decreases in snail kite numbers in the annual count are due to mortality, dispersal (into areas not counted), decreased productivity, or a combination of these factors. Despite these problems in interpreting the annual counts, the data since 1969 have indicated a generally increasing trend (Rodgers *et al.* 1988, Bennetts *et al.* 1994). The annual counts since 1995 confirm a continued increasing trend. Most recently, use of telemetry and mark-recapture methods has improved the precision of population estimates and produced significant increases in population estimates (Robert Bennetts, University of Florida, personal communication, 2001).

The current distribution of the snail kite in Florida is limited to central and southern portions of Florida (Figure 4). Six large freshwater systems (the Upper St. Johns drainage, Kissimmee Valley, Lake Okeechobee, Loxahatchee Slough, the Everglades, and the Big Cypress basin) generally encompasses the current range of the species, although radio tracking of snail kites has revealed that the network of habitats used by the species also includes many other smaller widely dispersed wetlands within this overall range (Bennetts and Kitchens 1997a). Continuing radio-tracking work underscores the importance of these smaller, peripheral habitats that support large numbers of snail kites, particularly in years when the larger wetland areas are drier than average (Robert Bennetts, University of Florida, personal communication, 2001).

Recovery Plan Objective

Pursuant to the MSRP (Service 1999), to achieve downlisting the following criteria must be met: the 10-year average for the total population size is estimated as greater than or equal to 650, with a coefficient of variation less than 20 percent for the pooled data over the 10-year period; no annual population estimate is less than 500 in the 10-year period; the rate of increase of the population to be estimated annually or biannually, and over the 10-year period, will be greater than or equal to 1.0, sustained as a 3-year running average over 10 years; the feeding range of snail kites will not decrease from its current extent, including as a minimum, the St. Johns Marsh, the Kissimmee Chain of Lakes, Lake Okeechobee, Loxahatchee Slough, A.R.M. Loxahatchee National Wildlife Refuge, all of the WCAs, ENP, Big Cypress National Preserve, Fakahatchee Strand, Okaloacoochee Slough, and marshes surrounding the Corkscrew Regional Ecosystem Watershed (CREW) Land and Water Trust Corkscrew Swamp; and snail kite nestings regularly occurs over the 10-year period in the St. Johns Marsh, Kissimmee Chain of Lakes, Lake Okeechobee, and at least one of the present compartments of the WCAs. The Service recognizes that the snail kite is a resilient species in a highly changeable environment and, that to some degree, a "boom and bust" population fluctuation is characteristic of the species. The above criteria for reclassification to threatened are flexible enough to allow substantial declines in population within a given year, while setting goals over a 10-year period.

Analysis of the species/critical habitat likely to be affected

Cape Sable seaside sparrow

Habitat Trends

Historically, the Cape Sable seaside sparrow was found in freshwater and brackish water marshes from Carnerstown to the marl prairies adjacent to Shark River and Taylor sloughs, including the Cape Sable area. This area periodically experiences extensive flooding, fires, and hurricanes which may result in shifts in habitat suitability for the Cape Sable seaside sparrow created by changing vegetative composition and structure. Cape Sable seaside sparrows may have adapted to this natural disturbance by varying their distribution within their range as habitat suitability changed.

More recently, south Florida's ecosystems have been severely degraded by the C&SF Project which encompasses 17,913 mi^2 (46,600 km^2) from Orlando to Florida Bay, and includes about 990 miles (1,600 km) of canal and levees, 150 water control structures, and 16 major pump stations. This system has disrupted the natural volume, timing, quality, and flow of surface and ground water throughout the Everglades. The Cape Sable seaside sparrow's short hydroperiod prairie habitat is contained entirely within the C&SF Project and has been extensively altered by this project (Nott *et al*. 1998).

The suitability of short-hydroperiod, mixed-marl prairie communities for the sparrow is driven by a combination of hydroperiod and periodic fires (Kushlan and Bass 1983). Sparrows tend to avoid tall, dense, sawgrass-dominated communities; spike-rush (*Eleocharis* spp.) marshes; extensive cattail (*Typha* spp.) monocultures; long-hydroperiod wetlands with tall, dense vegetative cover; and sites supporting woody vegetation (Werner 1975, Bass and Kushlan 1982). Fires prevent hardwood species from invading these communities and prevent the accretion of dead plant material, both of which decrease the suitability of these habitats for Cape Sable seaside sparrows.

Nesting has been observed from late February through early August (Service 1983). The currently preferred nesting habitat appears to be a mixed marl prairie community that often includes muhly grass (*Muhlenbergia filipes*) (Stevenson and Anderson 1994). The majority of nesting occurs in the spring when large areas of the marl prairies are dry. Stuart Pimm (then of University of Tennessee, personal communication, 1996) suggests that nesting will not be initiated if water levels are at a depth greater than 4 inches (10 cm) during the breeding season. When water levels rise above the mean height of the nests off the ground, sparrows cease breeding (Lockwood *et al*. 1997). The end of the breeding season appears to be triggered by the onset of the summer rains.

<u>Critical habitat</u>

Critical habitat for the Cape Sable seaside sparrow was designated on August 11, 1977 (50 CFR §17.95), before the full distribution of the subspecies was known. The critical habitat, as designated, does not adequately account for the distribution of the present-day core sub-populations, or the areas necessary for continued survival and recovery. The Service has recently concluded that re-designation of critical habitat is warranted, and will be completed as funding and priorities allow. An important area west of Shark River Slough, which until 1993 supported one of two core sub-populations (nearly half of the entire population), is not included within the original designation, and has been undergoing detrimental changes in habitat structure as a result of water management practices. Additionally, other parts of the originally designated critical habitat have been converted to agriculture, and are no longer occupied by sparrows. Thus, Cape Sable seaside sparrow critical habitat requires significant review and redesignation. Constituent elements are also not included within the original designation of critical habitat for the sparrow. A key constituent element for the Cape Sable seaside sparrow should be a hydroperiod pattern that maintains the preferred vegetative communities for successful breeding. During the breeding season, surface water levels should be at or below the surface within the short-hydroperiod prairies, and should be achieved through adherence to a rainfall-driven operational schedule. Adherence to such a regulation schedule will provide for restoration of hydropatterns that best support Cape Sable seaside sparrows, in addition to other native Everglades species. Other constituent elements should include vegetative structure necessary to support successful breeding.

Water quality

Water quality has been and will continue to be a major concern in the Everglades. The Corps' 1994 C-111 GRR mentioned mercury and nutrients as the greatest threats to water quality in the region. At this time, elevated mercury levels are still an issue. There is ongoing research by United States Geological Survey (USGS) that indicates sulfate rich agricultural runoff reaching the Everglades may exacerbate the mercury problem. While extensive data on other water quality constituents, including metals, organics, and field parameters are available, nutrients, pesticides, and to some extent salinity have become the primary focus of water quality protection efforts in the Everglades region.

The Everglades is a naturally low-nutrient system, the background concentration of total phosphorus (TP) within pristine areas of ENP is thought to be in the range of 6 to 10 parts per billion (ppb). Although nutrient threshold research is ongoing, many members of the scientific community already agree that the minimum TP concentration that affects vegetation patterns and periphton algae communities could be as low as 10 to 20 ppb. Human-induced sources of nutrients, more specifically those that input phosphorus (P) into the Everglades system, result in changes in vegetation patterns and periphyton communities. It is recognized that nutrient loads delivered to ENP will vary depending on the source of the water and the location where water is delivered. Untreated water that enters the Everglades Protection Area (ENP and the WCAs) from the northern Everglades Agricultural Area (EAA) regularly contains TP at much higher than background concentrations. Actions are being taken to ensure that EAA discharge water will have a concentration of 50 ppb P or lower, prior to release into the Everglades Protection Area.

At the southern end of the WCAs, water is discharged into the Shark River Slough (SRS) area of ENP via the S-12 structures and the SDCS (L-31N/C-111) via the S-334 and S-335 structures. Effective October 2003, interim criteria for TP input to the SRS area are 9 ppb during wet years and 14 ppb during dry years. In December 2006, the long-term limits of 8 ppb during wet years and 13 ppb during dry years will become effective. Water discharged from C-111 basin canals to the Taylor Slough and panhandle areas of ENP is composed of water from some or all of the following sources: deliveries from the WCAs made via pump station S-331/S-173, seepage from ENP, and local runoff/seepage from the South Dade Agricultural Area that is adjacent to the L-31N and C-111 canals. Phosphorus loads and concentrations at the S-332, S-175, and S-18C structures are influenced by the relative magnitude of contributions from these water sources.

Habitat management

Fire management and control of exotic woody vegetation will be essential to restoration and maintenance of Cape Sable seaside sparrow habitats. ENP is currently implementing exotic vegetation control measures as well as developing a park-wide fire management plan. Early research in this area (Werner 1975) suggested that sparrow use of habitat areas declined dramatically four years after fire in the Taylor Slough area. Taylor (1983) offered that the relationship may depend on soil depths, with sparrows reoccupying sites with shallow soils about four years after a burn and remaining at low densities (2 to 5 males per 40.5 ha) for up to ten years. On deeper soils or on soils without pinnacle rock, sparrows were present in the second breeding season after a burn and increased in numbers through the fourth year. More recent research (Curnutt *et al*. 1998) documents increasing sparrow numbers up to at least ten years following fire. Several recent authors (Curnutt *et al*. 1998, Nott *et al*. 1998, Pimm *et al*. 1996) agree that observed annual or biannual fire return frequencies over large areas of the sparrow's eastern habitats are directly linked to reduced hydroperiods in these areas produced by previous and current water management practices, and are the most likely cause of declines, and failure to recover, in sub-populations F and C. This effect is exacerbated by invasion of exotic and other woody vegetation over much of the eastern marl prairies, rendering the habitat unsuitable for sparrow breeding even when fire frequencies are reduced. In addition, sub-population B habitat has not experienced a large-scale fire since 1989, and ENP fire experts warn that occurrence of a large, possibly catastrophic fire in this area is only a matter of time. In fact, in 2001, a fire started between the S-332B and S-332D pump stations, and spread west to about one-third of the area occupied by sub-population B. Additional research is now funded to determine optimum fire frequencies for each habitat area and to develop effective fire management techniques for restoring and maintaining suitable sparrow habitat.

Conclusion

The IOP-Alt.7R includes features that address each of the concerns that led the Service to conclude that the ISOP and draft IOP EIS alternatives would not likely meet the requirements of the February 19, 1999, biological opinion RPA for the sparrow. The RPA hydroperiod and nesting habitat availability requirements for sub-population A are provided to the maximum extent possible via previously agreed operations of the S-12s and related structures. Similarly, in the area of sub-population B, in the central portion of the sparrow's range, IOP-Alt.7R is unlikely to result in any significant change to the hydroperiod since the issuance of the February 19, 1999, biological opinion. This area is far enough away from the water control features that it remains unaffected by the operational water delivery schedule. Consequently, implementation of IOP-Alt.7R will have no effect on sparrows or designated critical habitat in sub-populations A or B.

Additional seepage reservoirs (S-332B, C, and D), the B-C connector reservoir, and limits on pumping and overflow into ENP should provide biological conditions similar to those expected under the original February 19, 1999, biological opinion in natural areas adjacent to the L-31N canal that need to be managed to reduce fire risk for sparrow habitats. In the February 1999 biological opinion sparrow sub-populations C, D, and F required the timing and volume of water delivery to minimize the amount of breeding habitat rendered unsuitable by over-dry conditions. Unlike the western marl prairies, the concern with the eastern marl prairies is not the flooding of nesting habitat, but the diversion of natural water flow to the west, causing drier habitat conditions, invasion of woody shrubs, and frequent fires that create unsuitable habitat conditions that preclude the birds from successfully reproducing. The IOP-Alt.7R features and operations have not been modeled, but some extrapolations can be made from model runs produced for IOP-

Alt.7, which included both S-332B reservoirs (S-332B West is the existing reservoir and S-332B North is the new proposed reservoir). These reservoirs are adjacent to sparrow sub-population F.

The hydrologic model that was used to assess the performance of IOP-Alt.7 was the South Florida Water Management Model (SFWMM). This model is used to predict hydrologic conditions resulting from proposed changes in the C&SF Project in south Florida, roughly from Lake Okeechobee and east of the lake, south to Florida Bay. Its domain does not extend west of the Big Cypress National Preserve. The SFWMM operates on a fairly coarse spatial grid of two-mile by 2-mile cells, which are usually grouped into clusters of three or more cells ("indicator regions") to improve accuracy of interpreting the model output. Each of these indicator regions is identified and defined to allow project planners to ascertain conditions of importance over a relatively homogeneous area; furthermore, each indicator region is assigned a "performance measure," or desired set of hydrologic conditions, as predicted by the SFWMM, to be met via the project under consideration. Model output can then be expressed in terms of the frequency that the SFWMM can predict that an indicator region either meets or exceeds (the latter condition often expressed as "exceedences") its performance measure, and these predictions can be expressed in a variety of types of graphical outputs. It is important to note that no one type of graphical output fully captures hydrologic conditions at an indicator region; instead, one must rely on several types of output for an indicator region to assess the effects of a proposed action in an indicator region. Finally, the SFWMM not only predicts hydologic conditions spatially, but it also uses a 31-year period of record of actual rainfall in the area to capture a range of meteorologic conditions.

In the case of the modeling effort associated with IOP-Alt.7, there was an indicator region (IR) established for each of the six sparrow sub-populations. Five of these indicator regions (those corresponding to sub-populations B, C, D, E, and F) also serve to predict impacts to designated critical habitat for the sparrow. Because IOP-Alt.7 included the same two reservoirs associated with the S-332B pump station, the output for IR 58 may be used to predict conditions for sub-population F to gain insight on how IOP-Alt.7R might perform in that area. The model was run to predict conditions that would have occurred over the 31-year period of record of rainfall had the C&SF Project been operated under IOP-Alt.7 under either one of its two operational modes: (1) assuming that there were never any regulatory releases from WCA-3A via the S-333 structure in the L-29 canal ("no WCA-3A regulatory releases") and (2) assuming that there were always regulatory releases from WCA-3A via the S-333 structure in the L-29 canal ("WCA-3A regulatory releases"). The model was not run, however, to simulate the actual proposal to operate under both conditions, depending on the water levels in WCA-3A relative to its regulation schedule proposed under IOP-Alt.7. The output must therefore be viewed as simulating a "worst case" in terms of overdrying (in the case of "no WCA-3A regulatory releases") and overhydrating (in the case of "WCA-3A regulatory releases").

Accordingly, the SFWMM predicted that, if there were never any regulatory releases from WCA-3A though the S-333 structure, then there would have been 21 more times that water levels would fall below those that support sparrow habitat than would have occurred under the February 1999 biological opinion RPA, but 22 fewer times that they would become too deep. Conversely, if regulatory releases occurred all of the time, then there would have been 96 fewer times that water levels would become too low, but 94 more times that they would have become too deep. This information was conveyed via graphical output ("Number of weeks high/low water depth criteria exceeded") that does not indicate how long these "exceedences" occurred or by how much the acceptable conditions were exceeded. To gain this information, the modeling for IOP-Alt.7 also provided a graph ("Normalized weekly stage hydrograph") for each indicator region to depict predicted water levels at that location over the 31-year period of record of rainfall. Examination of this hydrograph indicates that there were relatively few times that deviations from the RPA were even evident. The SFWMM predicts that water levels would be higher than under the RPA only five times in 31 years, and that (1) four of these times were during the nesting season, but only two of those times would raise water levels above the ground (a condition that would interrupt nesting); and (2) these high-water events would only occur only if regulatory releases were being constantly made from WCA-3A through the S-333 structure. No extremely low water levels were detectable from this hydrograph for either mode of operations.

Based on this information as the best available predictor of conditions for sub-population F, we conclude that the actual operation of IOP-Alt 7R will cause somewhat longer hydroperiods and deeper conditions in this area during the nesting season, but only if the regulatory releases are being made during that time. The fact that the model predicts that these are substantial enough to appear on the hydrograph only twice in 31 years reinforces the expectation that regulatory releases of this magnitude are rare during the dry season. We therefore conclude that it is unlikely that IOP-Alt.7R will cause damaging conditions for sparrow sub-population F, or its associated critical habitat, in the interim before CSOP is implemented. Furthermore, since the C and D reservoirs are proposed to be operated as they would under the C-111 Project (i.e., to the benefit of ENP), we can assume that operations of those reservoirs would also have little if any negative impact on sparrow sub-populations C and D. Finally, sparrow sub-population E is far enough away from water management structures to avoid impacts from the reservoirs, and the hydrograph produced under IOP-Alt.7 supports this expectation. In fact, the degradation of the lower portion of the L-67 Extension should provide biological conditions for this sub-population equivalent to those expected under the original February 1999 biological opinion RPA.

The primary purpose of the IOP is to provide for water management operations in south Florida to comply with the Service's February 19, 1999, biological opinion and incidental take statement for the endangered Cape Sable seaside sparrow until CSOP is implemented. The water management structures currently in place allow enough operational flexibility to produce hydrologic benefits to sparrow habitat with implementation of IOP-Alt.7R, thereby providing as much protection to the sparrow as would MWD. The IOP-Alt.7R will provide for water deliveries that mimic more natural water flow conditions across the sparrow's nesting habitat. Therefore, the Service anticipates these conditions will provide for the frequency of nesting opportunities and maintenance of nesting habitat necessary for the sparrow's long-term viability. Further, no adverse effects are anticipated due to construction because the Corps has agreed to incorporate provisions for endangered species monitoring in association with construction activities ("Construction Monitoring Plan") into the proposed actions.

Based on the best currently available scientific information, the Service has determined that IOP-Alt.7R represents an additional RPA for water-management actions to avoid jeopardy to the Cape Sable seaside sparrow and would not destroy or adversely modify designated critical habitat. Specifically, IOP-Alt.7R must be implemented in combination with all other RPA components contained in the February 19, 1999, biological opinion with the exception of component #6, requiring the completion and operation of MWD by 2003. Since IOP-Alt.7R only addresses the water management needs of the sparrow, all other RPA requirements contained in the February 19, 1999, biological opinion will continue to apply. Furthermore, in order to qualify as a substitute for the water management provision of the February 1999, biological opinion, RPA, IOP-Alt.7R must be implemented as described in the Interim Operation Plan-Final Recommended Plan (Table 1), including the detailed provision for pre-storm/storm/storm recovery operations as outlined in the October 2001 SDEIS (additional language provided in Table 1). Consequently, the Service hereby amends the February 19, 1999, biological opinion to include IOP-Alt.7R as a second RPA option in terms of water management requirements. The original RPA in the February 19, 1999, biological opinion included the requirement for operational implementation of MWD by December 2003. Accordingly, compliance with either the February 19, 1999, biological opinion, or the water management actions outlined by IOP-Alt.7R (in conjunction with the other requirements of the original RPA) will provide the Service's recommendations for compliance with the Endangered Species Act.

Wood stork

IOP-Alt.7R is not likely to produce water levels as low as the original RPA for wood stork habitat in southern and eastern WCA-3A; however, wood storks have been documented as successfully nesting and raising young under conditions that have been produced under the current ISOP (Frederick *et al.* 2000). Based on the best currently available scientific information, the Service has concluded that IOP-Alt.7R is consistent with implementation of the water management provisions of the existing RPA. The Service anticipates that IOP-Alt.7R is not likely to cause additional effects to the wood stork beyond those analyzed in our February 19, 1999, biological opinion. Accordingly, the February 19, 1999, biological opinion and incidental take statement will continue to provide the Service's recommendations for compliance with the Endangered Species Act, and the wood stork will not be considered further.

Eastern indigo snake

The eastern indigo snake is not likely to be adversely affected by the proposed actions because the proposed actions will not substantially reduce the spatial extent of the natural habitat types utilized by the eastern indigo snake. The Service anticipates that individual snakes will adjust to expected gradual shifts in the location or composition of natural habitats, resulting in insignificant effects. Since the Corps has agreed to incorporate all the standard protective measures for the eastern indigo snake to ensure that no snakes are injured or killed during construction activities ("Construction Monitoring Plan"), the Service has determined that construction activities associated with IOP-Alt.7R are not likely to adversely affect the eastern indigo snake. Consequently, implementation of IOP-Alt.7R is not likely to adversely affect the eastern indigo snake, and this species will not be considered further.

Florida panther

Habitat Trends

Habitat loss, habitat fragmentation, habitat degradation, and increased human disturbance resulting from agricultural and residential development are considered among the primary threats to long-term panther persistence. Statewide, between 1936 and 1987, cropland and rangeland increased 4.23 million acres (1.72 million hectares) or 30 percent, urban areas increased by 3.95 million acres (1.60 million hectares) or 538 percent, while herbaceous wetlands declined by 3.88 million acres (1.57 million hectares) or 56 percent and forests declined by 4.30 million acres (1.74 million hectares) or 21 percent (Kautz 1993, Kautz 1994). Kautz (1994) estimated that the 21 percent loss of forests was the equivalent of 35 to 70 male panther home ranges and 100 to 200 female panther home ranges. Continued development associated with the expansion of Florida's urbanized east coast, urban sprawl on the west coast, and the spread of agricultural development in the south Florida interior, have placed increasing pressure on panthers and panther habitat (Maehr 1990b, Maehr *et al*. 1991a, Maehr 1992b). Agricultural development continues to replace and fragment panther habitat. Over 83 percent of the 1.6 million acres (648,000 hectares) of agricultural land in southwest Florida is categorized as rangeland. Between 1986 and 1990, row crop acreage increased by 8,990 acres (3,640 hectares) or 21 percent; sugarcane increased by 16,000 acres (6,475 hectares) or 21 percent; citrus increased by 54,000 acres (21,850 hectares) or 75 percent; and rangeland, much of it suitable for panther occupation, decreased by 160,000 acres (64,750 hectares) or 10 percent. Rangeland losses were about evenly divided between agricultural and urban development (Townsend 1991). The most recent information currently available from this area indicates that the amount of urban land and transitional land cleared and prepared for urban development between 1975 and 1993 increased from 641 square miles to 1,372 square miles; or 23 percent of Charlotte, Collier, Glades, Hendry, Lee, and Sarasota counties combined (Southwest Florida Regional Planning Council 1995).

Rapid development in southwest Florida has compromised the ability of landscapes to support a self-sustaining panther population (Maehr 1990b, 1992b). Maehr (1990a) reports that there are approximately 2.2 million acres (880,000 hectares) of occupied panther range in south Florida and that approximately 50 percent of the known breeding distribution is comprised of landscapes under private ownership. Maehr (1990a) indicated that development of private lands may limit panther habitat to landscapes under public stewardship.

Because of their wide-ranging movements and extensive spatial requirements, panthers are sensitive to habitat fragmentation (Harris 1985). Past land use activity, hydrologic alterations, road construction, and lack of fire management (Dees *et al.* 1999) have affected the quality and quantity of panther habitat. The effect of invasive plants on panther habitat utilization, particularly melaleuca, is unknown. As the remaining forested uplands are lost, sloughs containing cypress, marsh, and shrub wetlands comprise a greater percentage of the remaining habitat available to panthers, relative to habitat historically available to the species.

Public lands available to the panther within the action area have increased from 2.3 million acres in 1984 to 2.8 million acres in 2001. The reader should note that, due to habitat quality, not all publicly owned land is suitable for panther occupation (*e.g.* mangrove islands and open water habitats); however, although Maehr (1990b) and others postulated that publicly owned lands could not support additional panthers, expansion of panthers into those areas since 1995 has been dramatic. Of the 78 panthers currently known to the Service, 68 are found on these public lands (Roy T. McBride, personal communication, 2001).

Habitat management

Prescribed burning is probably the single most important habitat management tool available to public land stewards. Dees *et al.* (1999) examined panther use of habitat in response to prescribed burning at Florida Panther National Wildlife Refuge and Big Cypress National Preserve between 1989 and 1998. A positive temporal response to prescribed burns occurred in the year following the burn and is likely due to the rapid regrowth of vegetation, which in turn attracted white-tailed deer. Panther use of the burned area gradually declined after the first year and ended after four years. Prescribed burn rotations on both study sites is four years, but unfavorable weather conditions and logistics may sometimes extend the rotation.

Mortality

Florida panther vehicular trauma (n = 45) between February 13, 1972, and June 30, 2001, averaged 1.5 panthers per year. Males (n = 25) accounted for 56 percent of the vehicular trauma documented, and females (n = 19) for 42 percent. The gender of one panther (2 percent) could not be determined (Land *et al.* 2001). Although the relative significance of vehicular trauma to other sources of mortality is not entirely known, it has been the most often documented source of mortality (Maehr 1989, Maehr *et al.* 1991b) because the death of uncollared panthers due to intraspecific aggression, old age, disease, etc. will often go undetected. Vehicular trauma in the panther population core has been eliminated on Interstate 75 and certain segments of Highway 29 through the use of wildlife underpasses and fencing (Lotz *et al.* 1996, Land *et al.* 2001). Vehicular trauma still occurs on outlying rural roads and efforts are underway to address the issue.

<u>Recovery actions</u>

To restore health and viability, a genetic management program was implemented with the release of eight female Texas cougars into south Florida in 1995. This program was designed to restore the depressed panther genetic pool through the replacement of material from this formerly contiguous subspecies, without significant alteration in the basic genetic makeup of the panther or swamping the existing gene pool which may be adapted to local environmental conditions (Service 1994).

In addition, ten Florida panther kittens, five male and five female, were removed from the wild between February 1991 and August 1992 for captive breeding purposes. The kittens ranged in age from ten days to eight months and represented progeny of 11 different adult panthers. Two females died in captivity in 1992. One died after heart surgery in an attempt to correct an atrial septal heart defect and one died of unknown causes. Two captive males died of severe respiratory distress after being released to the wild in southern Big Cypress National Preserve in 1997. Six panthers remain in permanent captivity, one male and one female each, at White Oak Conservation Center in Yulee, Florida; Lowry Park Zoo in Tampa; and at the Jacksonville Zoo (Land and Taylor 1998).

<u>Conclusion</u>

The IOP-Alt.7R is likely to alter individual panther habitat use and movements in the short-term, but it will not substantially reduce the spatial extent of the natural habitat types utilized by the panthers in the eastern Everglades. In the case of the proposed reservoirs, no more than 2,611 acres of agricultural land where panthers have been recorded would be permanently converted to reservoirs that have been scraped down to the limerock base and periodically inundated and dried out. The 2,611 acres directly affected by the proposed action will result in the loss of 0.12 percent of panther habitat (Maehr 1990a). The permanent loss of 2,611 acres of habitat for panther prey may reduce foraging opportunities for dispersing sub-adults and adult panthers residing in the eastern Everglades; however, the Service anticipates that individual panthers will adjust to expected gradual shifts in the location or composition of natural habitats, thereby resulting in insignificant effects.

This tract of land represents low-quality habitat having low nutrient and frequently saturated soils that do not produce the quality or quantity of forage required to support large numbers of deer, feral hogs, and other panther prey items. Furthermore, the sites of the proposed reservoirs are largely in agricultural use (Figure 3), primarily row crop, with little available cover. In fact, one of the proposed reservoir sites (S-332B) was previously a grove that has recently been taken out of agricultural production and plowed under due to citrus canker concerns.

The maximum disturbance intensity, or amount of panther habitat directly affected by the proposed action, at the population level is 2,611 acres, or 0.12 percent, of an estimated 2.2 million acres (890,000 hectares) occupied by the panther (Maehr 1990a). The disturbance intensity at the individual level is 1.05 percent and 2.79 percent of the average home range of a male and female panther, respectively. These figures represent a “worst-case” scenario. However, while the scraping and varying water levels would preclude the development of the kind of vegetation that supports the panther’s primary food sources (*i.e.,* white-tailed deer and hogs), periodic dry-downs could attract raccoons, which are an alternate source of prey for the panther.

Beneficial effects would occur through overall habitat improvements expected in eastern ENP due to the operations of the SDCS and the operations of the existing and new reservoirs associated with the S-332B, C, and D pump stations. These actions will provide a more stable hydrologic regime in the eastern side of ENP where panthers have been recorded. The Florida panther depends on a landscape mosaic that historically included the short-hydroperiod marl prairies that would benefit from increased hydroperiods predicted to occur under IOP-Alt.7R along the eastern flank of Shark River Slough. These improved hydroperiods would reduce the incidence of unnatural wildfires, and return this area to a condition more like the pre-drainage ecotype that would have supported panthers during that time.

While the construction of the reservoirs may reduce the use of that area by panthers, its use, coupled with the higher stages in portions of the SDCS, is expected to reverse the pattern of overdrainage that has characterized the marl prairies in ENP along the SDCS. As a result, the Service anticipates an improvement in the water levels of the short-hydroperiod marl prairie type of habitat that would have supported panthers in this landscape ecotype during pre-drainage times. Quantifying the extent of improvement is difficult, since the best available predictor is the output of the South Florida Water Management Model (SFWMM), which operates on a relatively coarse (two-mile by two-mile) grid scale. Furthermore, extreme care needs to be taken when attempting to extrapolate model output to actual conditions. Finally, the pace of plan development has precluded modeling the effects of the plan as presented in the reinitiation letter. Our assessment of the effects of the action is therefore based on the best-available sources of information, which are: (1) the model results of assuming that there would be 400 acres of reservoir associated with the S-332B pump station, with no overflow except during emergency storm events, and (2) analyses by staff at Everglades National Park that operating the S-332C reservoir at a maximum depth of 2.0 feet during non-emergency conditions would reestablish desired short-hydroperiod marsh conditions in adjacent marshes (Tom VanLent, Everglades National Park, personal communication). We therefore base our evaluation of effects of the action on the assumption that it is possible to extrapolate from these two sources of information that operations of the S-332D reservoir and the B-C connector reservoir could produce similar results.

The results of modeling the effects of the existing and proposed S-332B north reservoirs only via the SFWMM indicate that 11 cells (each representing 2 square miles on a side, or 44 square miles total) lying immediately north, west, and south of the proposed reservoir would benefit, unfortunately information in the SDEIS does not quantify that improvement. Similarly, model output for sparrow sub-population C, which is represented by 2 of these 11 cells, does predict an overall improvement in IOP-Alt.7R resulting in a 4 to 9 percent increase in hydroperiod over the 1995 Base condition (increases up to a pre-drainage condition are considered beneficial). Hydroperiods in 6 other cells that overlie areas eight or more miles south, where panthers have also been recorded, would become slightly wetter (*i.e.,* their hydroperiods would be longer but less than 30 days longer) and 2 would become wetter (*i.e.,* their hydroperiods would become over 30 days longer) than the estimated pre-drainage conditions. The extent to which these changes would affect panther habitat is not clear, but the net improvement is predicted to be seen in 3 grid cells, or over approximately 12 square miles (7,680-acres). We infer from this information that the expected operations of the other reservoirs will have a similar stabilizing effect on panther habitat associated with operations of those reservoirs.

The IOP-Alt.7R will involve the construction of three reservoirs, S-332B, C, and D (1,340 acres) and a B-C connector reservoir (171.3 to 1,271 acres), within an area that has documented use by the Florida panther. These reservoirs will be created by scraping the surface down to limestone, and it will be flooded during at least part of the year. Although most of the habitat in the footprint of the reservoirs is agricultural land, there have been five documented radio-telemetry locations of panthers occurring within this area. However, any potential short-term impacts are anticipated to have insignificant effects to individual panthers. Therefore, the Service has determined that the panther is not likely to be adversely affected with implementation of IOP-Alt.7R. Long-term beneficial effects are expected to occur through the improvements in the neighboring short-hydroperiod rocky marl wetlands via a return to a more natural hydrologic regime that would support vegetation more typical of that used by panthers in this area during pre-drainage conditions.

Snail kite

In the February 19, 1999, biological opinion, the Service concluded that the snail kite would be adversely affected by the C&SF Project operations, at that time known as Test 7, Phase I, of the Experimental Program of Water Deliveries to Everglades National Park. No incidental take of snail kites was anticipated; however, our incidental take analysis was developed based on the premise that the original RPA would be implemented. The original RPA would have eliminated detrimentally deep water levels and long hydroperiods in southern and eastern WCA-3A, as water was shifted from WCA-3A in order to meet the RPA targets for water releases east of the L-67 Extension. As detailed earlier in the *Amended Consultation History*, the Corps is proposing not to implement the original RPA, and has developed IOP-Alt.7R as the biological equivalent for providing the same protection to the Cape Sable seaside sparrow as would the water management provisions of the original RPA. The IOP-Alt.7R will not provide the same relief in terms of hydrologic improvements to the southern and eastern portions of WCA-3A as would the original RPA.

The Corps has agreed to implement a "Construction Monitoring Plan" for snail kites that will avoid disturbance to nesting snail kites, and construction activities will only occur within, or nearly within, existing structure footprints. Thus, construction activities associated with IOP-Alt.7R are not likely to adversely affect the snail kite. The Service concurs, however, that operational implementation of IOP-Alt.7R could adversely affect snail kites and designated snail kite critical habitat in WCA-3A.

ENVIRONMENTAL BASELINE

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area. The environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the action under review in the consultation.

Status of the species within the action area

The action area for the biological opinion includes the range of the snail kite in central and south Florida. The information contained in the section titled *Status of the Species/Critical Habitat*, subsections titled *Status and Distribution*, establishes the Environmental Baseline for this species. These subsections for the snail kite are incorporated here by reference.

Factors affecting the species environment within the action area

Snail kite

Habitat trends

This analysis describes factors affecting the environment of the Everglade snail kite within the action area, which has been defined to include the current occupied range and designated critical habitat of the snail kite in central and southern Florida.

The principal threat to the snail kite is the loss or degradation of wetlands and littoral zones of lakes in central and South Florida. The C&SF Project encompasses 17,913 square miles (46,600 km^2) from Orlando to Florida Bay and includes about 990 miles (1,600 km) each of canals and levees, 150 water control structures, and 16 major pump stations. This system has disrupted the volume, timing, direction, and velocity of freshwater flow. Drainage of Florida's interior wetlands has reduced the extent and quality of habitat for both the apple snail and the snail kite (Sykes 1983b). Nearly half of the Everglades has been drained for agriculture and urban development (Davis and Ogden 1994). The Everglades Agricultural Area alone eliminated 3,051 square miles (8,029 km^2) of the original Everglades, and the urban areas in Miami-Dade, Broward and Palm Beach counties have also reduced the extent of habitat. North of ENP, which represents only about one-fifth of the original extent of the Everglades, the remaining marsh has been dissected into five shallow impoundments, the WCAs. Although the major drainage works completed conversion of wetlands to agriculture in the Everglades Agricultural Area by about 1963, loss of wetlands continues to the present at a slower, but significant, rate.

Critical habitat

Critical habitat for the snail kite was designated in 1997 and includes portions of the WCAs (1, 2, and 3), portions of ENP, western portions of Lake Okeechobee, the Strazzulla and Cloud Lake reservoirs in St. Lucie County, and portions of the St. Johns Marsh in Indian River County. A complete description of the snail kite critical habitat is available in 50 CFR §17.95. Although the critical habitat that was designated for the snail kite did not include constituent elements, water-level management is required to maintain favorable habitat conditions that are considered necessary to ensure the species survival. Lake Okeechobee and surrounding wetlands are major nesting and foraging habitats, however radio tracking data has revealed that the network of habitats used by the snail kite includes many other smaller widely dispersed wetlands within its overall range (Bennetts and Kitchens 1997a).

Water quality effects

Degradation of water quality, particularly runoff of phosphorous from agricultural and urban sources, is another factor affecting snail kite habitats. The Everglades was historically an oligotrophic system, but major portions have become eutrophic. The concentration of total phosphorus in Lake Okeechobee almost doubled from 49 μg/L in 1973 to 98 μg/L in 1984 (Janus *et al.* 1990). Most of this increase has been attributed to non-point source runoff from agricultural lands north of the lake, in the Kissimmee River, Taylor Slough, and Nubbin Slough drainages (Federico *el al.* 1981). Eutrophication also is a concern in the Kissimmee Chain of Lakes. Nutrient enrichment leads to growth of dense stands of herbaceous emergent vegetation, floating vegetation (primarily water hyacinth and water lettuce), and woody vegetation, which inhibits the ability of snail kites to find food. Regulation of water stages in lakes and the WCAs is particularly important to maintain the balance of vegetative communities required to sustain snail kites.

Reduction of nutrient loading to marshes is needed to slow the growth of dense vegetation which hampers efficient foraging by snail kites. Efforts to reduce nutrient loading are being conducted to benefit the south Florida ecosystem as a whole, and will have benefits to a number of fish and wildlife species in addition to the snail kite. Best Management Practices (BMPs) have been effective in reducing nutrient input to Lake Okeechobee from the Kissimmee River, Taylor Slough, and Nubbin Slough drainages. BMPs are included in implementation provisions of the Everglades Forever Act of 1994 (Chapter 373.4593 Florida Statutes), as are the construction of Stormwater Treatment Areas. More effort needs to be directed at identifying and rectifying problems with nutrient inputs to the peripheral habitats so critical to the snail kite during drought.

Contaminant analyses have been conducted on snail kites and apple snails, and all contaminant residues (DDT, DDD, DDE, dieldrin, PCBs, mercury, lead, and arsenic) have been found at low levels (Stickel *et al.* 1969, 1970, 1984; Lamont and Reichel 1970; Wiemeyer *et al.* 1980; Sykes 1985; Sykes *et al.* 1995; Eisemann *et al.* 1997).

Other effects

Habitat modification through the construction of, continued use of, and improvements to camps sites in the WCAs are expected to continue, as is the use of tree islands in WCA-3A for traditional native American uses by the Miccosukkee Tribe of Indians of Florida.

Habitat management

Water management actions in the Everglades and in the lakes are the single most important human-controlled factor in survival and recovery of the snail kite. Six large freshwater systems are located within the current range of the snail kite, which was defined earlier as included in the action area: Upper St. Johns drainage, Kissimmee Valley (and the Kissimmee Chain of Lakes), Lake Okeechobee, Loxahatchee Slough, the Everglades, and the Big Cypress basin (Beissinger and Takekawa 1983, Sykes 1984, Rodgers *et al.* 1988, Bennetts and Kitchens 1992, Rumbold and Mihalik 1994, Sykes *et al.* 1995). A balanced approach to water level management is required to maintain favorable habitat conditions for the snail kite.

The abundance of its prey, apple snails, is closely linked to water regime (Kushlan 1975; Sykes 1979, 1983a). Nearly continuous flooding of wetlands for one year is needed to sustain apple snail populations (Sykes 1979, Beissinger 1988). On the other hand, prolonged drying of wetlands, especially in an impounded area with little variation in water depth, can cause the local depletion of apple snails. Snyder *et al.* (1989) attributed poor reproductive success of snail kites in WCA-3A in years following drought to a lag time between re-flooding and recovery of apple snails to levels that allow higher nesting success.

The kite nests over water, and nests become accessible to predators in the event of unseasonal drying (Beissinger 1986, Sykes 1987c). When low-water stages occur during the nesting season on Lake Okeechobee and the Kissimmee Chain of Lakes, snail kites frequently nest in the waterward edge of herbaceous vegetation, where nests are more vulnerable to collapse due to the inability of the vegetation to support the nest and the greater exposure to wind, waves, and boat wakes. The location of the nests closer to open water during periods of low water also exposes snail kites to a potentially greater level of human disturbance.

Bennetts *et al.* (1988) found that snail kites nesting in WCA-3A used wetlands having multi-year hydroperiods ranging from about 84 percent to 99 percent. However, Bennetts and Kitchens (1997a) have emphasized that foraging snail kites use a heterogeneous mosaic of wetlands. Snail kites will forage in shorter hydroperiod portions (wet prairies) within larger areas of longer hydroperiod (predominance of slough or lacustrine communities). Snail kites will also forage in smaller sloughs within areas that are primarily wet prairies. Therefore, in defining the desired future condition of the WCAs following hydropattern restoration, one must recognize the importance of a heterogeneous landscape within wetlands of relatively long (>85 percent) average hydroperiod. One must also acknowledge that these areas will dry out periodically. In evaluating the effects of these drying events on the demography of the snail kite, one must consider the average interval between drying events, their duration, and their spatial extent. Localized drying events are thought to have little adverse effect on the snail kite population, but droughts across the region extending from the St. Johns Marsh and the Kissimmee Chain of Lakes to the southern Everglades are likely to have adverse effects, particularly if the droughts occur in two or more consecutive years (Bennetts and Kitchens 1997a, 1997b).

Recent snail kite research (Bennetts and Kitchens 1997a) suggests that maintaining deep, impounded pools, like those seen in southern and eastern WCA-3A under current conditions, will result in degradation of snail kite nesting habitat due to the loss of woody vegetation and degradation of foraging habitat due to the loss of wet prairie communities. Continuous flooding of wetlands for more than four of five years is particularly associated with degradation of snail kite foraging habitat (DOI 2001, Bennetts *et al.* 1998; Robert Bennetts, University of Florida, personal communication, 1998). In WCA-3A, snail kites have increasingly moved their nesting activity to areas of higher elevations and shorter hydroperiods as lower elevation habitat areas have been degraded by high water levels sustained by water management practices (Bennetts *et al.* 1998). As this shift continues, snail kites may increasingly "run out" of suitable nesting habitats within WCA-3A and be forced to move to other areas of suitable habitat (Kitchens *et al.*, 2002).

With adequate planning, extreme drawdowns can apparently be carried out without adversely affecting the snail kite and can enhance foraging conditions by opening up the dense vegetation. Any restrictions preventing rapid drainage of water need to be removed in advance. However, recent research by Darby *et al.* (1997a) indicates that early drying may be far more detrimental to apple snail populations (and by extension, detrimental to snail kites) than the incidental take of snail kite nests that early drying is intended to avoid. Darby *et al.* (1997b) suggest that the adverse impact on apple snails is lessened when drying occurs after the snails have completed their reproductive cycle and the young are of sufficient size to withstand a drying event. Not surprisingly, this point is normally reached during late May or June, the time that the natural system reached its minimum water levels. Further research on apple snail biology and the effects of the timing of drying events on snail kite nesting is needed to provide water managers guidance on the timing of intentional drawdowns that will maximize the long-term benefits on habitat structure while minimizing the short-term adverse impacts on snail kites and apple snails.

Control of aquatic weeds has probably improved foraging conditions for the snail kite in a few localized areas by opening up dense growths of water hyacinth, water lettuce, and *Hydrilla*; however, spraying should not occur near snail kite nests located in non-woody species (*e.g.*, cattail, bulrush). The SFWMD, the FWC, and the Florida Department of Environmental Protection have cooperated in closing areas to herbicide spraying around snail kite nests, thereby reducing the risk of nest collapse in Lake Okeechobee and Lake Kissimmee. More research is needed on the long-term effects of the herbicides being used on the aquatic food web in general, and particularly apple snails with respect to snail kites.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities.

Factors to be considered

The action area has been re-defined in the section titled *Amended Description of the Proposed Action*, subsection titled *Action Area*, as the range of the Florida panther and snail kite in central and south Florida. The areas most affected by the proposed action include the footprint of two new pump stations (S-356 and S-332C); three new reservoirs (1,340 acres) associated with the S-332B, C, and D pump stations; the new B-C connector reservoir (141.3 to 1,271 acres); the short-hydroperiod marl prairies in eastern ENP along the SDCS (on the east flank of Shark River Slough); agricultural lands immediately east of the SDCS; the short-hydroperiod prairies on the western side of Shark River; and southern WCA-3A.

It is our understanding that the proposed action, beginning with construction of the new pump stations and three reservoirs as described in the section titled *Description of the proposed action*, would take effect as early as March 2002. Operational implementation would begin once the Record of Decision for IOP has been signed (please reference the *Description of the proposed action* for specific construction locations and associated operational criteria). Operations would be in place until the CSOP is implemented. Currently, CSOP is scheduled to be complete by December 2005, with full implementation over the following year to two years.

Further, the information provided with the March 15, 2002, reinitiation letter indicates that several portions of IOP-Alt.7R are likely to be phased in, depending on the rate of acquisition of private lands; how quickly the boundary of Everglades National Park can be adjusted; the availability of funds to construct the reservoir associated with the S-332D pump station; modeling to determine the appropriate operations of the S-332D to assist in flood control but not at the expense of the surrounding marsh condition; modeling to ascertain the operations of the S-356 pump station to control seepage; and the operational experience gained during the 2002 wet season and modeling to determine whether raising the northern, western, and southern levees of existing S-332B reservoir would compromise flood protection to a significant degree. Our analysis of the effects of the action are predicated on all of these structures being constructed and operated to achieve flood control while also hydrating marshes in eastern Everglades National Park and western Southern Glades Wildlife and Environmental Area to conditions that support short-hydroperiod marl prairies during non-emergency conditions.

Analysis for effects of the action

Snail kite

Potential direct adverse effects of IOP-Alt.7R on the snail kite would be disturbance to nesting pairs associated with construction activities that will occur within potential snail kite nesting sites; however, the Corps has agreed to implement a "Construction Monitoring Plan" for snail kites that will avoid disturbance to nesting birds. The removal of the lower four miles of the L-

67 Extension will affect a feature within designated critical habitat for the snail kite, but because the levee itself does not provide habitat suitable for snail kites, the Service has determined that its elimination will not have a direct adverse effect on the critical habitat. An indirect effect of removal of the levee may be localized lowering of water levels in the southern portion of designated critical habitat within ENP, as would restricting flows through the S-12 structures; however, recent data collected by Bennetts and Kitchens (1997a) indicates that this portion of ENP lies at the edge of the range in south Florida that is actually used by adult kites. Consequently, IOP Alt.7R construction activities are not likely to adversely affect the snail kite or their designated critical habitat.

Indirect adverse effects that would not have been caused by the February 1999 biological opinion RPA are the deep water levels and long hydroperiods in southern and eastern WCA-3A as predicted by modeling of IOP-Alt.7. As detailed earlier in the *Consultation History* section of this document, the Corps chose not to implement the original RPA, and developed IOP-Alt.7R as an alternative method for avoiding jeopardy to the Cape Sable seaside sparrow. Although the Service agrees that IOP-Alt.7R will provide the same protection to the sparrow as would the water management provisions of the original RPA, IOP-Alt.7R is not predicted to provide the same relief to the southern and eastern portions (as predicted in Indicator Regions 14, 17, and 19) of WCA-3A as would the original RPA. Rather, IOP-Alt.7R would maintain historically deep, impounded pools that degrade nesting habitat due to the loss of woody vegetation in southern and eastern WCA-3A, and degrade foraging habitat due to the loss of wet prairie communities. This loss of nesting substrate and foraging habitat will adversely effect snail kites by reducing the reproductive potential of snail kite individuals using this area.

Degrading the lower section of the L-67 Extension is, however, expected to enhance habitat conditions for the snail kite by increasing hydroperiods and may increase water flows and volumes in Shark River Slough. Likewise, the effects of operating the S-356 pump station as proposed would be limited to the additional amount of water that could physically be passed to northeast Shark River Slough via the culverts under Tamiami Trail (U.S. Route 41). The rehydration of northeast Shark River Slough should improve habitat conditions for snail kites and other wading birds.

The disturbance intensity, or amount of snail kite critical habitat that could potentially be disturbed by water level manipulations in southern and eastern WCA-3A, would be approximately 88,300 acres out of a total of 841,600 acres of designated critical habitat, or approximately 10.5 percent of the available designated critical habitat. Other portions of designated snail kite critical habitat are not expected to be affected by IOP-Alt.7R.

Bennetts and Kitchens (1997a) report that their data indicate the snail kite depends on a considerably more extensive set of areas than is currently provided by the currently designated critical habitat. They report that approximately 40 percent of the locations where they found snail kites with radio-transmitters were outside designated critical habitat, and 67 percent of adults fixed with radio-transmitters used areas outside of designated critical habitat. The authors concluded that the 67 percent figure would likely have been higher had their observations been of longer duration.

Snail kite use in the action area fluctuates greatly depending on the pattern of rainfall and resulting local water levels in the range of waterbodies that comprise designated critical habitat. Although sharp declines have occurred in the counts since 1969 (for example, in 1981, 1985, and 1987), it is unknown whether decreases in snail kite numbers in the annual count are due to mortality, dispersal (into areas not counted), decreased productivity, or a combination of these factors. Despite these problems in interpreting the annual counts, the data since 1969 have indicated a generally increasing trend; however, the degree of this apparent increase in the snail kite's population needs to be confirmed with alternative methods of estimating population size (Bennetts and Kitchens 1997).

The best available information leads us to conclude that IOP-Alt.7R is likely to continue to adversely affect 10.5 percent of snail kite designated critical habitat in southern and eastern WCA-3A. Considering that: (1) Our knowledge of snail kite movements since the designation of critical habitat in 1977 indicates that snail kites make extensive use of wetlands outside of designated critical habitat; (2) there is no evidence that the snail kite population is decreasing, and, may actually be increasing; (3) snail kites are highly vagile; (4) the proposed action will not substantially reduce the spatial extent of the natural habitat types utilized by snail kites; and, (5) individual snail kites are anticipated to adjust to expected gradual shifts in the location or composition of natural habitats, the Service concludes that the likely amount of degradation of snail kite designated critical habitat anticipated from implementation of IOP-Alt.7R is unlikely to appreciably diminish or preclude the role of critical habitat in the survival and recovery of the species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act.

Anticipated future actions in the action area that will eliminate, fragment, or degrade panther habitat include the issuance of SFWMD permits. The SFWMD is responsible for permitting the construction, alteration, operation, maintenance, removal and abandonment of surface water management systems within its jurisdictional boundaries (SFWMD 1996). The SFWMD has issued 382 surface water management and ground water use permits for agricultural projects covering 948,480 acres (384,000 hectares) of the Immokalee Rise Physiographic Region

(Mazzotti *et al.* 1992). This equals 64 percent of the occupied panther range in private ownership. Many of the permits have not been executed and the Service is therefore unable to ascertain the extent and consequence of proposed agricultural developments.

Tribal ceremonies and hunting camp use on tree islands in WCA-3 are anticipated to continue, or, in the case of hunting camps, even increase to some extent, at least in the short-term. Use of these tribal and hunting camps may eliminate some cover used by panthers for day bedding and stalking prey, which could slightly reduce foraging opportunities and result in increased competition for food and possibly an increased risk of intraspecific aggression among panthers in the area; due to the fact these activities will not alter the hydrology in the area or otherwise impact trees or tree islands, no reduction in available nesting habitat is anticipated.

Despite the cumulative effects of many decades of wetland development and water management practices, which have resulted in degradation of snail kite foraging habitat due to the loss of wet prairie communities and degradation of nesting habitat due to the loss of woody vegetation, snail kite numbers have exhibited an increasing trend over the past decade. The minor increase in the chances of disturbance to nesting kites in the WCAs due to future tribal and hunting camp use would be a negligible incremental addition to the baseline adverse effects.

CONCLUSION

After reviewing the current status of the snail kite and its designated critical habitat, the environmental baseline for the action area, the effects of the proposed IOP-Alt.7R and the cumulative effects, it is the Service's biological opinion that IOP-Alt.7R is not likely to jeopardize the continued existence of the Everglade snail kite, and is not likely to adversely modify designated snail kite critical habitat.

For this amendment, in addition to the review conducted for the Everglade snail kite and its designated critical habitat, an analysis was completed for the Florida panther, wood stork, eastern indigo snake, Cape Sable seaside sparrow and its designated critical habitat. The Service determined that IOP-Alt.7R, as proposed, would not introduce adverse impacts above and beyond those anticipated in the February 19, 1999, biological opinion to the Cape Sable seaside sparrow and its designated critical habitat, wood stork, and eastern indigo snake. The Service determined that while panther habitat is likely to be adversely affected, there will be a net improvement in habitat (i.e., back to a pre-drainage condition for short-hydroperiod marl prairies as a component of the native landscape mosaic upon which the panther population depends) in the long-term. The anticipated short-term effects to individual panthers were determined to be insignificant and would not rise to the level of "take", as defined by the Endangered Species Act. Finally, IOP-Alt.7R is likely to adversely affect, but is not likely to jeopardize, the continued existence of the Everglade snail kite or destroy or adversely modify designated snail kite critical habitat. The amount of snail kite critical habitat predicted to be adversely affected is estimated to be 10.5 percent of the designated critical habitat.

Our understanding of snail kite movements and habitat use has increased since critical habitat was originally designated in 1977. Snail kites are nomadic in nature, make extensive use of wetlands outside of currently designated critical habitat, and adjust to gradual shifts in the location or composition of preferred habitats. In addition, there is no evidence that the snail kite population has been decreasing, in fact, it may actually be increasing. Consequently, the Service concludes the anticipated degradation of snail kite critical habitat in southern and eastern WCA-3A from implementation of IOP-Alt.7R is unlikely to appreciably diminish or preclude the role of critical habitat for the survival and recovery of the species.

AMENDED INCIDENTAL TAKE STATEMENT

INTRODUCTION

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Endangered Species Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require other parties to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, grant, or other documents, the protection coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(I)(3)].

Amount or extent of take anticipated

Snail kite

The focus of our concerns with regard to incidental take for snail kites in the February 19, 1999, biological opinion was the possibility of excessively low water in WCA-3A, since the original RPA assumed a greater capacity of the S-333 structure to convey water out of WCA-3A than what the Corps has since maintained is feasible. The IOP-Alt.7R assumes the more restricted capacity of the S-333 structure. Therefore, IOP-Alt. 7R has less capacity to lower water levels in snail kite habitat in WCA-3A than we assumed would be the case in 1999. Accordingly, our concern with implementation of IOP-Alt. 7R is the possibility of water levels being too high in

WCA-3A to provide suitable nesting and foraging habitat for snail kites. The effect on snail kites would be the loss of isolated trees for perch hunting and nesting, and a general conversion of prairie habitat suitable for foraging to a more slough-like condition less suitable for foraging.

It becomes problematic in attempting to quantify incidental take due to the vagile nature of the birds and the availability of habitat, including designated critical habitat, not affected by IOP-Alt.7R. In addition, the taking of individual snail kites is likely to be masked by losses due to variable rainfall, heat and wind conditions that alter evapotranspiration, vegetation changes, and antecedent conditions, which all contribute to changing water levels. Finally, the best currently available scientific information on the effects of flooding on tree islands in WCA-3A does not allow us to distinguish between damage occurring due to decades of cumulative high water impacts and an additional increment of damage that would likely be caused by continuing high water over the relatively short-period of IOP-Alt.7R implementation (Heisler *et al.* 2001, Lorraine Heisler, Service, personal communication, 2001). It is not possible to turn to SFWMM results to gain insight on how the original February 1999, biological opinion, RPA compares to IOP-Alt. 7 (which proposed the same operations for WCA-3A and associated structures as does IOP-Alt. 7R) because the RPA ("RPA02") that was modeled for that effort assumed the more restricted flow capacity of the S-333 structure. Therefore, to address anticipated incidental take, this amendment adds a high-water criterion to our February 19, 1999, biological opinion, incidental take statement, which previously contained only a low-water criterion.

The Service now anticipates that IOP-Alt.7R will result in incidental take in the form of "harm" resulting from significant habitat modification or degradation that results in death or injury to individual snail kites by impairing essential breeding and foraging patterns measured by the frequency and duration of high-water events. The two indicator regions where snail kites have been documented (Bennetts and Kitchens 1997a) and for which SFWMM results predict are the most problematic in terms of experiencing excessively high water levels are Indicator Regions 14 and 19. Thus, if actual operations of IOP-Alt.7R produce higher water levels than those predicted to occur via the SFWMM in Indicator Regions 14 (Southern WCA-3A) and 19 (Eastern WCA-3A), as measured by a gauge or gauges mutually agreed upon by the Service and the Corps as compared to a five-year rolling average of the model output for those indicator regions, then the Corps will have exceeded the incidental take authorized by this amendment. This incidental take is anticipated to occur annually until implementation of CSOP. The CSOP is scheduled for full structural and operational implementation no later than 2007. This level of incidental take is to be considered an addition to the incidental take authorized by the February 19, 1999, biological opinion and is amended herein.

Effect of the take

Habitat conditions suitable for snail kites require a balanced approach to water management. Prolonged drying of wetlands, especially in an impounded area with little variation in water depth, can cause local depletion of apple snails (Darby *et al.* 1997a). Low water during the nesting season also may force snail kites to nest on poor quality sites, where marginal nesting substrate results in greater nest structure collapse, increases vulnerability to human disturbance, predation and lowers nesting success (Service 1999). Conversely, over many years, prolonged periods of high water levels drown out woody vegetation required for successful nesting (Heisler et al. 2001) and create deep pool conditions in marsh vegetation that result in unsuitable habitat conditions for effective snail kite foraging (Bennetts and Kitchens 1997a). The IOP-Alt.7R will maintain the historical trend of long hydroperiods with deep impounded pools in southern and eastern WCA-3A. These conditions will injure snail kites by significantly impairing essential nesting and foraging patterns, which results in lower fecundity and reduced survival rates of any juvenile kites that are forced to move to other areas as a result of this habitat degradation.

In the accompanying biological opinion amendment, the Service determined that this level of anticipated take is not likely to result in jeopardy to the snail kite. Despite the cumulative effects of many decades of wetland development and water management practices that have reduced the total area of snail kite habitat, and damaged and likely reduced the carrying capacity of existing habitats for snail kites, snail kite numbers have exhibited an increasing trend over the past decade. In addition, snail kites are nomadic in response to water depth, hydroperiod, food availability, nutrient loads, and other habitat changes (Bennetts *et al.* 1994) and likely minimize the effect of poor localized habitat conditions by their ability to move long distances across a mosaic of suitable wetland habitats within the landscape. Although the proposed action would continue water management operations that damage snail kite habitats in southern and eastern WCA-3A for an estimated five years, this represents a small fraction of the many decades of cumulative high and low water impacts that have caused existing damage to snail kite habitats within WCA-3A. Moreover, most individual snail kites affected by this additional damage are likely to move to other available habitat areas. Therefore, incidental take of snail kites anticipated to result from implementation of IOP-Alt.7R is unlikely to significantly affect the snail kite population.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of snail kites.

Within the operational flexibility provided by IOP-Alt.7R, the Corps must adjust day-to-day operations to minimize adverse effects to snail kites by reducing durations and depths of high water within southern and eastern WCA-3A as much as possible without increasing adverse effects to the Cape Sable seaside sparrow. Factors to be explored in accomplishing this should include: 1) reduction of inflows to WCA-2A; 2) increased capacity of outflow structures from WCA-3A that will not increase harm to sparrow habitats; and 3) reduction of inflows to downstream areas, thereby creating increased capacity and getaway potential for release of WCA-3A flood waters.

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the Endangered Species Act, the Corps must comply with the following terms and conditions, which implements the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary;

1. The Corps must, in cooperation with the SFWMD, Service, ENP, FWC, Miccosukee Tribe, and other appropriate groups, explore ways to reduce inflows to WCA-3A that contribute to high water in snail kite habitats. This must include exploration of inflows from both natural system sources such as WCA-2A and Lake Okeechobee and inflows from non-natural sources such as urban flood control inflows at S-9 and agricultural inflows from the Everglades Agricultural Area.

2. The Corps must, in cooperation with the SFWMD, Service, ENP, FWC, Miccosukee Tribe, and other appropriate groups, explore ways to increase outflow capacity of the S-333, S-12C, and S-12D structures that will alleviate high water in WCA-3A without increasing harm to sparrow habitats.

3. The Corps must, in cooperation with the SFWMD, Service, ENP, FWC, Miccosukee Tribe, and other appropriate groups, explore ways to reduce inflows to the L-29 canal and to the South Dade Conveyance System, thereby increasing capacity and getaway potential for routing WCA-3A flood waters through these areas.

4. The Corps must ensure that monitoring programs are sufficient to: (1) track the yearly status of the snail kite and any vegetative shifts that may occur within snail kite habitats; and, (2) determine the number of snail kites initiating nesting in the action area and the success rate of those nesting efforts each year. These monitoring efforts must be in place prior to initial implementation of IOP-Alt.7R (currently scheduled for June 28, 2002) and must continue for the life of the project. A research plan must be submitted to the Service for approval prior to implementation.

5. Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office at 10426 N.W. 31 Terrace, Miami, FL 33172, (305)526-2610. Additional notification must be made to the Fish and Wildlife Service South Florida Field Office at 1339 20th St., Vero Beach, FL 32960-3559, (561)562-3909. Care should be taken in

handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Seek, within the operational flexibility provided by IOP-Alt.7R, to adjust day-to-day operations to benefit endangered wood storks nesting within the action area as necessary and appropriate.

2. Monitor surface and groundwater quality within the vicinity of S-332B and S-332D, and, through adaptive management, use monitoring data to minimize potential water quality effects to endangered Florida panther and Cape Sable seaside sparrow habitats.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the IOP-Alt.7R proposed structures and operations as outlined in the Corps' March 15, 2002, request for reinitiation of consultation. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) a new species is listed or critical habitat designated that may be affected by the proposed structures and operations; (3) new information reveals effects on the Corps' proposed structures and operations that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion amendment;

or (4) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion amendment. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions regarding this Biological Opinion, please contact Jay Slack, Field Supervisor, South Florida Ecological Services Field Office at (561) 562-3909.

Sincerely yours,

/S/

Sam D. Hamilton
Regional Director

cc:

WO, AES
Service, Atlanta, GA (Assistant Regional Director)
Corps, Jacksonville, FL (District Commander)
Everglades National Park, National Park Service, Homestead, FL (Superintendent)
FWCC, Vero Beach, Florida Dept. of Agriculture and Consumer Services, West Palm Beach, FL
Florida Dept. of Environmental Protection, Tallahassee, FL
SFWMD, West Palm Beach, FL (Executive Director)
Miccosukee Tribe, Miami, FL
Seminole Tribe, Hollywood, FL
Miami-Dade County DERM, Miami, FL

P:\Everglades\Listed Spp\CSSS\csss iop bo 3-28-02.wpd
st:horning:3-27-02

LITERATURE CITED

Bangs, O. 1899. The Florida Puma. Proceedings of the Biological Society of Washington. 13:15-17.

Bass, O.L., Jr., and J.A. Kushlan. 1982. Status of the Cape Sable sparrow. U.S. Department of the Interior, National Park Service, South Florida Research Center Report T-672; Homestead, Florida.

Belden, R.C. 1986. Florida Panther Recovery Plan Implementation - A 1983 Progress Report. Pages 159-172 *in* S.D. Miller and D.D. Everett, eds.. Cats of the World: Biology, Conservation and Management, Proceedings of the Second International Cat Symposium. Caesare Kleberg Wildlife Reserarch Institute; Kingsville, Texas.

Belden, R.C. 1988. "The Florida Panther" in Audubon Wildlife Report. 1988/1989. National Audubon Society; New York, NewYork. Pages 515-532.

Belden, R.C., W.B. Frankenberger, R.T. McBride, and S.T. Schwikert. 1988. Panther habitat use in southern Florida. Journal of Wildlife Management 52(4):660-663.

Beissinger, S.R. 1986. Demography, environmental uncertainty, and the evolution of mate desertion in the snail kite. Ecology 67:1445-1459.

Beissinger, S.R. 1988. Snail kite. Pages 148-165 *in* R.S. Palmer, eds. Handbook of North American Birds, Vol. 4, Yale University Press; New Haven, Connecticut.

Beissinger, S.R., and J.E. Takekawa. 1983. Habitat use and dispersal by snail kites in Florida during drought conditions. Florida Field Naturalist 11:89-106.

Bennetts, R.E., and W.M. Kitchens. 1992. Estimation and environmental correlates of survival and dispersal of snail kites in Florida. First annual report, prepared for the U.S. Fish and Wildlife Service and U.S. National Park Service, Florida Cooperative Fisheries and Wildlife Research Unit, University of Florida; Gainesville, Florida.

Bennetts, R.E., and W.M. Kitchens. 1997a. The demography and movements of snail kites in Florida. Final report. Florida Cooperative Fish and Wildlife Research Unit, National Biological Service, U.S. Department of the Interior; Gainesville, Florida.

Bennetts R.E., and W.M. Kitchens. 1997b. Population dynamics and conservation of snail kites in Florida: The importance of spatial and temporal scale. Colonial Waterbirds 20:324-329.

Bennetts, R.E., M. Collopy, and S.R. Beissinger. 1988. Nesting ecology of snail kite in WCA 3A. Florida Cooperative Fisheries and Wildlife Research Unit Technical report number 31, University of Florida; Gainesville Florida.

Bennetts, R.E., M.W. Collopy, and J.A. Rodgers, Jr. 1994. The snail kite in the Florida Everglades: a food specialist in a changing environment. Pages 507-532 *in* S.M. Davis and J.C. Ogden, eds. Everglades: the Ecosystem and its Restoration, St. Lucie Press; Delray Beach, Florida.

Bennetts, R.E., W.M. Kitchens, and D.L. DeAngelis. 1998. Recovery of the snail kite in Florida: Beyond a reductionist paradigm. Pages 486 - 501 *in* Transactions of the 63rd North American Wildlife and Natural Resource Conference.

Bent, A.C. 1937. Life histories of North American birds of prey. U.S. National Museum Bulletin 167.

Brown, L.H., and D. Amadon. 1976. Eagles, hawks, and falcons of the world. McGraw-Hill Book Company; New York, New York

Clark, W.S., and B.K. Wheeler. 1987. A field guide to hawks of North America. Houghton Mifflin Company; Boston, Massachusetts.

Cory, C.B. 1896. Hunting and fishing in Florida. Estes and Lauriat. Boston, Massachusetts.

Curnutt, J.L. 1996. Cape Sable seaside sparrow. Pages 137-143 *in* J.A. Rogers, Jr., H.W. Kale II, and H.T. Smith, eds. Rare and endangered biota of Florida: Volume five, birds. University Press of Florida; Gainesville, Florida.

Curnutt, J.L., and S.L. Pimm. 1993. Status and ecology of the Cape Sable seaside sparrow. Unpublished report prepared for the U.S. Fish and Wildlife Service and the National Park Service; Vero Beach, Florida.

Curnutt, J.L., A.L. Mayer, T.M. Brooks, L. Manne, O.L. Bass, D.M. Fleming, M.P. Nott, and S.L. Pimm. 1998. Population dynamics of the endangered Cape Sable seaside sparrow. Animal Conservation 1:11-21.

Darby, P.C., P. Valentine-Darby, and H.F. Percival. 1997a. Assessing the impact of the Lake Kissimmee restoration on apple snails. 1997 annual report. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Darby, P.C., P.L. Valentine-Darby, R.E. Bennetts, J.D. Croop, H.F. Percival and W.M. Kitchens. 1997b. Ecological Studies of Apple Snails (*Pomacea paludosa,* SAY). Special Publication SJ98-SP6, Florida Cooperative Fish and Wildlife Research Unit; Gainesville, Florida.

Davis, S.M. and J.C. Ogden. 1994. The everglades issues in a broader perspective. Pages 3-8 *in* S.M. Davis and J.C. Ogden, eds. Everglades: the Ecosystem and its Restoration. St. Lucie Press; Delray Beach, Florida.

Dean, T.F., and J.L. Morrison. 1998. Non-breeding season ecology of the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). 1997-1998 field season final report. Everglades National Park, Homestead, Florida.

Dees, C.S., J.D. Clark and F. T. van Manen. 1999. Florida panther habitat use in response to prescribed fire at Florida Panther National Wildlife Refuge and Big Cypress National Preserve. Final Report. University of Tennessee; Knoxville, Tennessee.

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler. 1979. Resource inventory and analysis of the Big Cypress National Preserve. Final Report to the National Park Service, University of Florida; Gainesville; and National Audubon Society Ecosystem Research Unit; Naples, Florida. 2 volumes.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1992. Birds in jeopardy. Stanford University Press; Stanford, California.

Eisemann, J.D., W.N. Beyer, R.E. Bennetts, and A. Morton. 1997. Mercury residues in South Florida apple snails (*Pomacea paludosa*). Bulletin of Environmental Contamination and Toxicology 58:739-743.

Federico, A.C., K.G. Dickson, C.R. Kratzer, and F.E. Davis. 1981. Lake Okeechobee water quality studies and eutrophication assessment. Technical publication 81-2, South Florida Water Management District; West Palm Beach, Florida.

Frederick, P., M. Ruane, and B. Hilton. 2000. Regional nesting reports: Water Conservation Areas 2 and 3. South Florida Wading Bird Report (South Florida Water Management District) 6(1): 2-3.

Hall, E.R. 1981. The mammals of North America Volume II. The Ronald Press Company; New York, New York.

Harlow, R.F. 1959. An evaluation of white-tailed deer habitat in Florida. Florida Game and Fresh Water Fish Commission. Tech. Bull. 5:1-64.

Harris, L.D. 1985. The fragmented forest. University of Chicago Press; Chicago, Illinois.

Heisler, I.L., D.T. Towles, L.A. Brandt, and R.A. Pace. 2001. Tree island vegetation and water management in the central Everglades. *In* A. van der Valk and F.H. Sklar, eds. Everglades Tree Islands. Kluwer Academic Publishing, Dordrecht, The Netherlands, *in press*.

Howell, A.H. 1932. Florida bird life. Coward-McCann; New York, New York.

Janus, L.L., D.M. Soballe, and B.L. Jones. 1990. Nutrient budget analyses and phosphorus loading goal for Lake Okeechobee, Florida. Internationale Vereinigung fur Theoretische und Angewandte Limnologie Verhandlungen 24:538-546.

Kautz, R.S. 1993. Trends in Florida wildlife habitat 1936-1987. Florida Scientist 56(1):7-24.

Kautz, R.S. 1994. Historical Trends Within the Range of the Florida Panther. *In* Proceedings of the Florida Panther Conference, Dennis B. Jordan, ed. Florida Panther Interagency Committee, November 1-3, 1994.

Kitchens, W.M., R.E. Bennetts, and D.L. DeAngelis. 2002. Linkages Between the Snail Kite population and wetland dynamics in a highly fragmented south Florida hydroscape. Pages 183-203 *in* J.W. Porter and K.G. Porter, eds. The Everglades, Florida Bay, and the Coral Reefs of the Florida Keys: An Ecosystem Sourcebook.. CRC Press; Boca Raton, Florida.

Kushlan, J.A. 1975. Population changes of the apple snail, *Pomacea paludosa*, in the southern Everglades. Nautilus 89:21-23.

Kushlan, J.A., and O.L. Bass, Jr. 1983. Habitat use and the distribution of the Cape Sable seaside sparrow. Pages 139-146 *in* T.L. Quay, J.B. Funderberg, Jr., D.S. Lee, E.F. Potter, and C.S. Robbins, eds. Occasional papers of the North Carolina Biological Survey, 1983-1985; Raleigh, North Carolina.

Kushlan, J.A., O.L. Bass, Jr., L.L Loope, W.B. Robertson, Jr., P.C. Rosendahl, and D.L. Taylor. 1982. Cape Sable seaside sparrow management plan. South Florida Research Center Report M-660. U.S. Department of the Interior, Everglades National Park; Homestead, Florida.

Lamont, T., and W. Reichel. 1970. Organochlorine pesticide residues in whooping cranes and Everglade kites. Auk 87:158-159.

Land, E.D. 1994. Response of the wild Florida panther population to removals for captive breeding. Final Report, Study Number 7571. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Land, E.D. and S.K. Taylor. 1998. Florida panther genetic restoration and management. Annual report, Study Number 7508. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. 2001. Florida panther genetic restoration and management. Annual report, Study Number 7500. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Lockwood, J.L, K. H. Fenn, J.L. Curnutt, D. Rosenthal, K.L. Balent, A.L. Mayer. 1997. Life history of the endangered Cape Sable seaside sparrow. Wilson Bulletin 109(4): 720-731.

Lockwood, J.L., K.H. Fenn, J.M. Caudill, D. Okines, O.L. Bass, Jr., J.R. Duncan, and S.L. Pimm. 2001. The implications of Cape Sable seaside sparrow demography for Everglades restoration. Animal Conservation 4:275-281.

Logan, T.J., A.C. Eller, Jr., R. Morrell, D. Ruffner, and J. Sewell. 1993. Florida panther habitat preservation plan - south Florida population. Prepared for the Florida Panther Interagency Committee.

Lotz, M.A., E.D. Land, and K.G. Johnson. 1996. Evaluation of State Road 29 wildlife crossings. Final Report, Study No. 7853. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1989. Florida panther road mortality prevention. Final Performance Report, Study No. 7502. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1990a. Florida panther movements, social organization, and habitat utilization. Final Performance Report, Study No. 7502. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1990b. The Florida panther and private lands. Conservation Biology 4 (2):167-170.

Maehr, D.S. 1992a. Florida panther. *In* Rare and Endangered Biota of Florida. Volume I: Mammals. S. R. Humphrey, (ed.). University Press of Florida; Gainesville, Florida.

Maehr, D.S. 1992b. Florida panther distribution and conservation strategy. Final Report, Study No. 7572. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1993. Response to the wild Florida panther population to removals for captive breeding. Final Report, Study No. 7571. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1997. The comparative ecology of bobcat, black bear, and Florida panther in south Florida. Bulletin of the Florida Museum of Natural History. University of Florida; Gainesville, Florida.

Maehr, D.S., J.C. Roof, E.D. Land, and J.W. McCown. 1989a. First reproduction of a panther (*Felis concolor coryi*) in Southwest Florida. U.S.A. Mammalia 25:37-38.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1989b. Early maternal behavior in the Florida panther (*Felis concolor coryi*). American Midland Naturalist 122:34-43.

Maehr, D.S., R.C. Belden, E.D. Land, and L. Wilkins. 1990a. Food habits of panthers in southwest Florida. Journal of Wildlife Management 54:420-423.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1990b. Day beds, natal dens, and activity of Florida panthers. Proceedings of the Annual Conference of Southeast Fish and Wildlife Agencies 44:000-000.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991a. Social ecology of Florida panthers. National Geographic Research & Exploration 7 (4):414-431.

Maehr, D.S., E.D. Land, and M.E. Roelke. 1991b. Mortality patterns of panthers in southwest Florida. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 45:201-207.

Maehr, D.S., R.C. Lacey, E.D. Lande, O.L. Bass, and T.S. Hoctor. 1999. A reassessment of Florida panther population viability analysis and recovery efforts from multiple perspectives. Paper presented at Population Viability Analysis: Assessing Models for Recovering Endangered Species. University of California, Berkeley and The Wildlife Society. San Diego, California. March 15-16, 1999.

Mazzotti, F.J., L.A. Brandt, L.G. Pearlstine, W.M. Kitchens, T.A. Obreza, F.C. Depkin, N.E. Morris, and C.E. Arnold. 1992. An evaluation of the regional effects of new citrus development on the ecological integrity of wildlife resources in southwest Florida. Final report. South Florida Water Management District; West Palm Beach, Florida.

McBride, R.T. 1976. The status and ecology of the mountain lion, Felis concolor stanleyana, of the Texas-Mexico border. M.S. Thesis, Sul Ross State University; Alpine, Texas.

Nicholson, D.J. 1926. Nesting habitats of the Everglade kite in Florida. Auk 43:62 67.

Nicholson, D.J. 1928. Nesting habits of seaside sparrows in Florida. Wilson Bulletin 40:234-237.

Nott, M.P., O.L. Bass, Jr., D.M. Fleming, S.E. Killeffer, N. Fraley, L. Manne, J.L. Curnutt, J.M. Brooks, R. Powell, and S.L. Pimm. 1998. Water levels, rapid vegetational changes, and the endangered Cape Sable seaside sparrow. Animal Conservation 1:23-32.

Pimm, S.L. 1998. An assessment of the risk of extinction for the Cape Sable seaside sparrow. Chapter 10, annual report 1998. Unpublished report prepared for the U.S. Army Corps of Engineers, U.S. National Park Service and the U.S. Fish and Wildlife Service; Vero Beach, Florida.

Pimm, S.L., and O.L. Bass, Jr. 2000. Range-wide risks to large populations: the Cape Sable sparrow as a case history. Draft report submitted to the Fish and Wildlife Service - Ecological Services, South Florida Field Office on October 4, 2000.

Pimm, S.L., K. Balent, T. Brooks, J. Curnutt, T. Fenn, N. Fraley, S. Killeffer, J. Lockwood, L. Manne, A. Mayer, M.P. Nott, G. Russell, and E. Stanton. 1996. Population ecology of the Cape Sable seaside sparrow, draft report. Unpublished report prepared for the U.S. National Park Service and the U.S. Fish and Wildlife Service; Vero Beach, Florida.

Post, W., and J.S. Greenlaw. 1994. Seaside Sparrow (*Ammodramus maritimus*). *In* The Birds of North America, No. 127 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Rodgers, J.A., Jr., S.T. Schwikert, and A.S. Wenner. 1988. Status of the snail kite in Florida: 1981-1985. American Birds 42:30-35.

Rodgers, J.A., Jr. and P.W. Stangel. 1996. Genetic variation and population structure of the endangered snail kite in south Florida. Journal of Raptor Research 30(3):111-117.

Roelke, M.E. 1990. Florida panther biomedical investigations. Final Performance Report, July 1, 1986 - June 30, 1990. Study No. 7506. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Roelke, M.E., J.S. Martenson, and S.J. O'Brien. 1993. The consequences of demographic reduction and genetic depletion in the endangered Florida panther. Current Biology 3:340-350.

Rumbold, D.G., and M.B. Mihalik. 1994. Snail kite use of a drought-related habitat and communal roost in West Palm Beach, Florida: 1987-1991. Florida Field Naturalist 22:29-38.

Schemnitz, S.D. 1972. Distribution and abundance of alligator, bear, deer, and panther in the Everglades Region of Florida. Report to the Florida Game and Fresh Water Fish Commission, Ft. Lauderdale, Florida in fulfillment of contract No. 14-16-0004-308.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1989. Florida panther viability analysis and species survival plan. Report to the U.S. Fish and Wildlife Service, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1992. Genetic management strategies and population viability of the Florid panther. Report to the U.S. Fish and Wildlife Service, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Service (U.S. Fish and Wildlife Service). 1967. Endangered and threatened wildlife. *Federal Register* Vol. 32: 4001. March 11, 1967.

Service (U.S. Fish and Wildlife Service). 1983. Cape Sable seaside sparrow recovery plan. U.S. Fish and Wildlife Service; Atlanta, Georgia.

Service (U.S. Fish and Wildlife Service). 1994. Final Environmental Assessment - Genetic restoration of the Florida panther; Atlanta, Georgia.

Service (U.S. Fish and Wildlife Service). 1999. Multi-species recovery plan for south Florida. U.S. Fish and Wildlife Service; Vero Beach, Florida.

Smith, G. 1970. Mystery cat. Florida Wildlife 24 (3):4-6.

Snyder, N.F.R., S.R. Beissinger, and R. Chandler. 1989. Reproduction and demography of the Florida Everglade (Snail) Kite. Condor 91:300-316.

South Florida Water Management District (SFWMD). 1996. Basis of review for Environmental Resource Permit applications within the South Florida Water Management District. West Palm Beach, Florida.

Southwest Florida Regional Planning Council. 1995. Strategic Regional Policy Plan of the Southwest Florida Regional Planning Council. North Fort Myers, Florida.

Sprunt, A., Jr. 1945. The phantom of the marshes. Audubon Magazine 47:15-22.

Sprunt, A., Jr. 1954. Florida bird life. Coward-McCann, Incorporated, and National Audubon Society; New York.

Stevenson, H.M. and B.H. Anderson. 1994. The birdlife of Florida. University Press of Florida; Gainesville, Florida.

Stickel, W.H., L.F. Stickel, and J.W. Spann. 1969. Tissue residues of dieldrin in relation to mortality in birds and mammals. Pages 74-204 *in* M.W. Miller and G.G. Berg, eds. Chemical fallout. Charles C. Thomas; Springfield, Illinois.

Stickel, W.H., L.F. Stickel, and F.B. Coon. 1970. DDE and DDD residues correlated with mortality of experimental birds. Pages 287-294 *in* W. P. Deichmann, ed. Inter-American conference on toxicology and occupational medicine, pesticide symposia, University of Miami, School of Medicine; Miami, Florida.

Stickel, W.H., L.F. Stickel, R.A. Dyrland, and D.L. Hughes. 1984. Aroclor 1254 residues in birds: lethal levels and loss rates. Archives Environmental Contamination and Toxicology 13:7-13.

Stieglitz, W.O., and R.L. Thompson. 1967. Status and life history of the Everglade kite in the United States. Bureau of Sport Fisheries and Wildlife, Scientific report Wildlife, Number 109.

Sykes, P.W., Jr. 1978. Endangered Florida Everglade kite. Pages 4-7 *in* H. W. Kale II, ed. Rare and endangered biota of Florida, Vol. 2. University Presses of Florida; Gainesville, Florida.

Sykes, P.W., Jr. 1979. Status of the Everglade Kite in Floridaó1968-1978. Wilson Bulletin 91:495-511.

Sykes, P.W., Jr. 1983. Snail kite use of the freshwater marshes of south Florida. Florida Field Naturalist 11:73-88.

Sykes, P.W., Jr. 1984. The range of the snail kite and its history in Florida. Bulletin, Florida State Museum, Biological Sciences 29:211-264.

Sykes, P.W., Jr. 1985. Pesticide concentrations in snail kite eggs and nestlings in Florida. Condor 87:438.

Sykes, P.W., Jr. 1987a. Snail kite nesting ecology in Florida. Florida Field Naturalist 15:57-84.

Sykes, P.W., Jr. 1987b. The feeding habits of the snail kite in Florida, USA. Colonial Waterbirds 10:84-92.

Sykes, P.W., Jr. 1987c. Some aspects of the breeding biology of the snail kite in Florida. Journal Field Ornithology 58:171-189.

Sykes, P.W., Jr., J.A. Rodgers, Jr., and R.E. Bennetts. 1995. Snail kite (*Rostrhamus sociabilis*) *in* A. Poole and F. Gill, eds. The birds of North America, Number 171, The Academy of Natural Sciences; Philadelphia, Pennsylvania; and the American Ornithologists Union; Washington, D.C.

Taylor, D.L. 1983. The seaside sparrow, its biology and management. Pages 147-152 *in* T.L. Quay *et al*., eds., Occasional papers of the North Carolina Biological Survey. North Carolina State Museum; Raleigh, North Carolina.

Terborgh, J. 1988. The big things that run the world - a sequel to E. O. Wilson. Conservation Biology 2:402-403.

Tinsley, J.B. 1970. The Florida panther. Great Outdoors Publishing Company; St. Petersburg, Florida.

Townsend, D. 1991. An economic overview of the agricultural expansion in southwest Florida. Unpublished report on file at South Florida Field Office, U.S. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Department of the Interior [DOI]. 1969. Environmental impact statement of the Big Cypress Swamp jetport. Washington, D.C.

Werner, H.W. 1975. The biology of the Cape Sable sparrow. Unpublished report prepared for the U.S. Fish and Wildlife Service. U.S. Department of the Interior, Everglades National Park; Homestead, Florida.

Wiemeyer, S.N., T.G. Lamont, and L.N. Locke. 1980. Residues of environmental pollutants and necropsy data for eastern United States ospreys, 1964-1973. Estuaries 3:155-167.

Young, S.P. and E.A. Goldman. 1946. The Puma - Mysterious American Cat. Dover Publications, Inc.; New York, New York.